

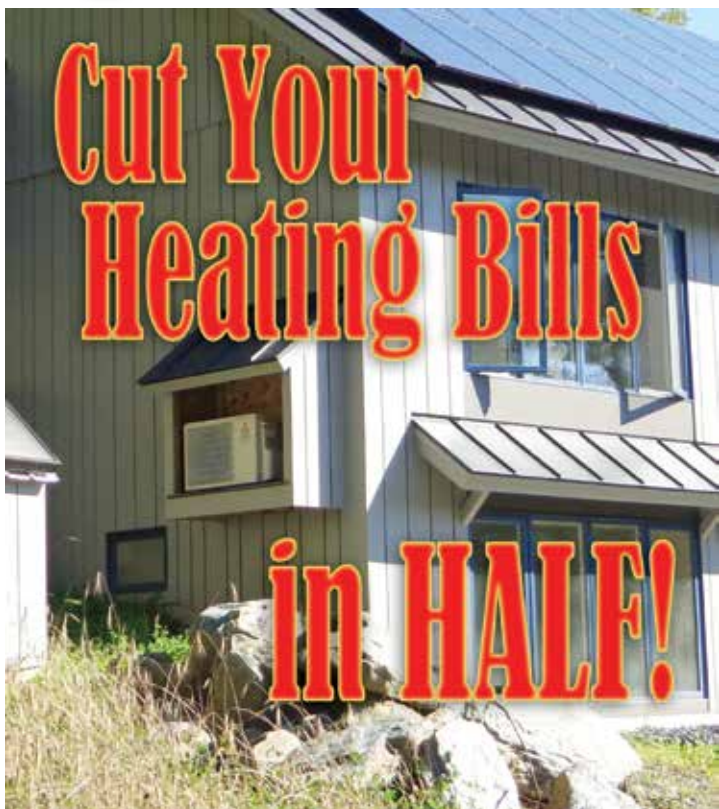
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Staff Article

Most people in New England could cut their heating bills in half, when the time comes to choose a new heating system.

Over the last couple years, we have seen more and more mention of air-source heat pumps in the news. Last year, we started to see some European countries talking about laws mandating the use of heat pumps in all new residential construction. This year, Green Mountain Power in Vermont offered to rent 200 heat pumps to customers, and 600 asked to get them.

Despite the presence in the news, most people seem to draw a blank when a heat pump is mentioned. Of those who think they know about them, some seem to think only of expensive, ground source systems, so-called geothermal heat pumps that are far beyond the economic reach of ordinary people.

An air-source heat pump is actually rather easy for most of us to understand, because most of us actually use them from time to time. It happens that an ordinary air conditioner is a heat pump of sorts. While it runs, an air conditioner extracts heat from a cool room and pumps it outside. While the science behind this seems obscure to many people, nearly everyone understands that it does work.

An air-source heat pump differs from an ordinary air conditioner in a couple of ways. First of all, it extracts heat from cold outside air and pumps it into a warm interior space, the opposite direction of the air conditioner's heat flow. We should note that most air-source heat pumps can work either way and function as air conditioners in the summer.

Second, air-source heat pumps are typically far more efficient than air conditioners. And this is where the business of cutting your heating bill in half comes in. Heat pumps do not create heat, the way electric

resistance heaters do. They move heat. It happens that moving heat requires far less effort than creating it. In fact, an air-source heat pump may use only 40% or less of the electricity that a standard electric heater does to heat a space.

Since the resistance heater converts all of the electricity it uses to heat, it is rated at 100% efficient. Since the air-source heat pump can move 2.5 times the heat that the resistance heater creates with the same amount of power, the heat pump is considered to be 250% efficient.

The best test of efficiency might be how well the heat pump performs in terms of costs. In New England, heat pumps turn out to be among the lowest cost heating options. Air source units are just a fraction more expensive to run than ground source, or geothermal, heat pumps, but they cost far less to buy and install. They can also be less costly to install than new fossil fuel heating systems. In fact, for many people they are no more expensive to run than conventional woodstoves.

Air source heat pumps are far less expensive than oil, propane, or conventional electric heaters. Another piece of good news is that they do not pollute, and can be powered by renewable electrical sources. In fact, they can, and are, being run off-grid.

Cont. on page 7

SOLAR GROWTH IN 2013

Astonishing Results for MA, NH & VT

How far have we come – and how far do we have to go – to meet our needs with solar?

By George Harvey

It is surprisingly difficult to answer even the simple question of what solar farm is largest in Massachusetts, New Hampshire, and Vermont. Every time we think we have found it, we find something new. The best we can hope for is to convey a good idea of how fast our energy production is changing -- in front of our eyes.

Massachusetts

We can be sure that the largest array in these three states is in Massachusetts, though we cannot be sure which of several it is. A number are being installed that could set records, each in its turn. We can only be sure no records are likely to last long.

In August of 2012, the 4.5 MW (megawatt) Westford Solar Park was said to be the largest



Photo by SayCheeeese

This 3 MW solar farm in Sharon Vermont is the largest in the state, as of 2013.

privately held solar array in New England. Soon after that, a 5.75 MW array was completed in Canton. A 6 MW array was completed in September of 2013 in Berkley, Massachusetts, but one being built in Carver may be larger.

The state had a total of 129 MW of installed solar in 2012, with the hope of reaching 250



Two solar installations in Orange Massachusetts with a combined capacity of 6.8 MW. Photo courtesy of GameChange Racking

MW by 2017. In the spring of 2013, applications for net metering had already greatly exceeded 250 MW, so the goal was changed. Now, Massachusetts is aiming for 1600 MW by 2020.

The number of small installations in Massachusetts is impressive. Every municipality has at least one system. The small town of Harvard had over seventy applications for solar installations in 2012, alone.

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Energy Efficiency - pp 20-29

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Energy Awareness, Understanding & Independence!

VIEW FROM THE TOP

Picking Up the Pace to Reach 20% Renewables by 2020



Vermont's current statewide comprehensive energy plan calls for 90% of our total energy use to come from renewable energy sources by the year 2050. Two months ago at

the Renewable Energy Vermont conference in Burlington, REV leadership announced the need for immediate progress toward the next step along that path: getting to 20% renewable energy by 2020*. As I mentioned in my last column, right now only 11% of our total energy consumption comes from renewables. (Remember that that figure for total energy use includes all electricity and fuels, including those used for heating and transportation.) Over the next seven years, to meet the 20%-by-2020 goal, we need to almost double the amount of in-state renewables, while also ramping up efficiency and conservation efforts.

How do we do this? It won't be easy, and will require major effort and leadership, as well as adjustments in thinking about how we all live and move around – but I expect these transitions have the potential to be exciting and joyful rather than onerous. Essentially, though, we know what we

have to do, and it all comes down to the numbers. Keep in mind that Vermont has approximately 220,000 homes, and currently uses 5000 MW average** (MWavg) in total energy through the year. Here is a big-picture overview

Energy Efficiency and Conservation. We need to electrify our economy – an electrified economy that is supportable by renewables. In many instances, reducing or eliminating energy use is relatively straightforward; take heating, for example. By converting to electricity-driven cold-climate heat pumps to heat our houses and businesses, we increase electrical energy usage, but this is an overall savings, because the technology itself is five times more energy efficient than the conventional heating systems of today. In other words, we get five times more heat energy out of a heat pump system compared to burning oil or propane directly. Burning fossil fuels wastes energy in refining and transporting the fuels, and then quite a lot of energy is lost in the heat in the exhaust. To save 175 MWavg of energy via efficiency (14% of our 2020 goal) and conservation (25%), we must implement many changes. Converting one-eighth of Vermont homes (27,500 homes) to cold-climate heat pumps would save about 50 MWavg or 14 million gallons of oil per year. Weatherization of 25% of our homes (55,000 homes) would save another 77 MWavg of energy. Mass transit, reduced commuting and selective reliance on some electric cars can fill the remaining gap in our efficiency and conservation

goals.

What you can do. Weatherize and insulate your home, and reduce personal energy use by moving to energy-efficient appliances, always with a preference for electrification of your home heating system to run on cold-climate heat pumps. If you don't live near where you work, consider changing this to seek out ways to reduce reliance on single-occupancy vehicles (electric or not).

Solar Electric and Solar Thermal Installations. We will need to plan on another 35%, or 158 MWavg, from solar electric and solar thermal (hot water) installations. Installation of solar hot water systems in one quarter of Vermont residences (55,000 homes) would cover 18 MWavg of need. Rooftop solar PV on one quarter of Vermont homes with solar PV yields another 36 MWavg or 275 MW of capacity. So then we would need to install another 104 MWavg of ground-based solar or 700 MW of installed capacity. To date, we have installed less than 40MW of solar electric capacity – only 6% of our 2020 goal! We need to at least double the amount of solar PV we install each year immediately; a 100% increase from each year to the next.

What you can do. Add a solar system for hot water to your home to maximize the efficiency of how you get hot water, and if you have an appropriate roof or land space, add solar PV also. If you have neither a suitable roof nor open land for solar PV, consider becoming part of a group net

metering initiative within your utility, so you can receive credits on your bill from a solar installation located elsewhere in your utility's service area.

In my next column I will write about how wind energy, biofuels and hydropower can make up the remaining 25% gap to meet our goal of 20% renewables by 2020. It is a huge task, and only one step on the way to the overall 90% by 2050 goal. We can do it, but only if we move much, much faster than we currently are moving. We need to work now to build a solid foundation for the larger shift away from dependence on fossil and nuclear fuels. Implementation support is necessary also – I believe a tax on carbon is absolutely essential, and is the next step towards reaching our goals. British Columbia has successfully implemented one – and now Vermont needs to lead the U.S. toward a secure and livable energy future.

*REV's guide to 20% by 2020:

<http://www.revermont.org/main/wp-content/uploads/REV-20-By-2020.pdf>

** Based on U.S. Energy Information Agency data from 2011, converting trillions of Btu's to megawatts. MWavg is the average continuous use of power from all sources.

David Blittersdorf is the President and CEO of AllEarth Renewables in Williston, VT, a company that specializes in the design and manufacture of the grid-connected AllSun Tracker solar energy system. He is also the founder of NRG Systems in Hinesburg, VT, and is the managing partner of Georgia Mountain Community Wind. ☘

LOCAL RENEWABLE ENERGY GROWING IN VERMONT

Strengthening the Net Metering Program

By Darren Springer, Deputy Commissioner, Vermont Public Service Department

In Vermont we are seeing locally produced, distributed renewable energy become a growing part of our portfolio thanks to the net metering program. Net metering allows families, farmers, communities, and businesses to generate their own electricity and feed the excess back to the grid. The program has spurred significant growth in renewable energy in Vermont over the last few years. According to our data at the Public Service Department, since the start of 2011, we have roughly tripled net metering capacity. We had about 12 megawatts then, and we have over 37 megawatts installed or pending today. Net metering's success is one of the reasons Vermont leads the nation in private-sector "green" jobs per capita according to the Bureau of Labor Statistics.

The most popular net metering technology has been applied in conjunction with solar-generated electricity. Consumer demand has helped make Vermont ninth in the nation in per capita solar installations. Electricity generation from solar helps reduce greenhouse gas emissions. In addition, solar energy has significant value to the grid in that it peaks during the summer when our statewide electricity demand also reaches its peak. This means that distributed solar energy can help save ratepayers money by avoiding the need

for new transmission projects to meet demand. VELCO, our transmission company, has already avoided hundreds of millions of dollars in transmission costs thanks to solar PV and energy efficiency.

During this past summer we learned that several utilities in Vermont reached or were nearing their caps on participation in the net metering program. That led to a statewide conversation on how to move forward. At the Public Service Department, we led several intensive stakeholder sessions that included utilities, renewable energy businesses, and environmental organizations to determine what the best ideas are for updating the program. We had two principal objectives in mind: to ensure that all Vermonters who want to "go solar" or participate in net metering can do so, and that the program accounts fairly for all costs and benefits.

In advance of the upcoming 2014 legislative session, the Department is working with legislators and stakeholders to shape a strong proposal to continue the net metering program. We believe there are opportunities to expand participation in the program while also achieving cost savings. In addition there are ideas for innovative pilot projects that could test new business models for the net metering program in the future.

More and more Vermonters want to invest in their own clean electricity generation. We are seeing growing numbers of solar panels on our roofs, solar

trackers in our farm fields, and solar arrays in our communities. By strengthening and improving the net metering program, we believe we can continue the strong growth in renewable energy for Vermonters while achieving cost savings for ratepayers.

Darren Springer is the Deputy Commissioner for the Public Service Department. Prior to joining the Department, Springer served for four years in the Washington, D.C. Office of U.S. Senator Bernard Sanders, as a Senior Policy Advisor for Energy and Environment, and later as Chief Counsel. ☘

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FLYING WITH THE SUN

By George Harvey

There is something fascinating about the idea of a solar-powered airplane. We might dream of quietly flying, without fuel, without emissions, proceeding at a leisurely pace from one airport to another.

Even some of the earliest experimental electric-powered aircraft had solar power. The first manned flight using an electric plane had a batter and solar panels to assist it. The battery could power a motor for up to five minutes. That was in 1979.

Progress was not fast, partly because of little perceived need for such a vehicle, but progress was made. In 2007, an Electraviva BL1E Electra became the first electric-powered aircraft to be given an official

imagination is about the Solar Impulse. A Swiss design, the first prototype for the craft took to the skies in December of 2009 for its first test flight in 2009. That flight was an almost unbelievable 350 miles long.

A newer model of the Solar Impulse set a record of 24-hour flight powered entirely by sunshine. That was in July of 2010.

The US public became very aware of the Solar Impulse when it flew from Mountain View, California to New York City in a series of flights between May 3 and July 6, 2013. Each flight was followed by a lengthy stay at the airport where the plane had landed.

The Solar Impulse is not a small plane. Its wingspan is 208 feet, about 13 feet



The Solar Impulse during its trip across American in Phoenix, Arizona. Photo by Cygnusloop99

registration.

Some of the implications are really rather amazing to think about. If an airplane can carry batteries sufficient to keep it aloft all night, and PVs sufficient to recharge the batteries during the day, it could remain in the air indefinitely. We saw this happen when a company called QinetiQ announced in the last week of 2010 that they had managed to keep a drone aircraft aloft for just over two weeks, before bringing it back to land.

Perhaps the first big story about solar-powered aircraft to capture the public

more than that of the original Boeing 747. It is very light, however, weighing only about 3500 pounds. It is powered by four motors of 10 horsepower each. Its lithium-ion batteries are charged by 11,000 solar cells covering its wings. Remarkably, its takeoff speed is just less than 23 mph, and it cruises at a speed of about 35 mph.

The story is still unfolding. The Solar Impulse crew intends to construct yet another airplane, with which they mean to fly around the world. That flight will probably be in 2015. At 35 mph, it will be a very long flight with lots of layovers. ✈

IDLE-FREE VT INC.

NO IDLING NEWS & UPDATES

Vermont Dept. of Health funds Idle-Free VT schools project

The Vermont Dept. of Health with funding from the federal CDC, has awarded a grant to Idle-Free VT to implement School No Idling Policies (SNIP). This project, in the interest of increasing outdoor air quality by reducing asthma triggers, will seek to increase the number of schools that adopt the model policy in Sec. 2 of the Vermont school bus idling rule for vehicles other than school buses on school grounds. Engaged in the project will be school boards, school administrators, teachers, students, parents, and energy committees. SNIP is running from Sept. 2013 to Aug. 2014.

REQUEST: School boards can be especially swayed by students. We have one great example of a Vermont student-led idle-free project (Barstow Memorial school featured on the SNIP webpage), that resulted in the school board adopting a no idling policy. We would like to know of other Vermont school idle-free projects with student participation (and if they led to school board policy adoptions).

Idle-Free VT concludes Idle-Free for Fleet\$ funded project

Idle-Free for Fleet\$, a project funded by the Vermont Dept. of Health / CDC in the interest of lowering Vermont's elevated asthma rate, concluded at the end of August. 37 business and municipal fleets in three Vermont counties — Addison, Orange and Washington — were given presentations showing the the benefits in avoiding unnecessary idling, myths and realities of idling, the health and economic impacts, prohibited idling laws in Vermont, model policies, and encouragement to adopt formal policies. There was also an introduction to green/eco-driving practices. The project final progress report can be seen at idlefreevt.org.

Vehicle owner's manuals discourage excessive idling

BMW's 3 Series (and other BMWs) 2013 owner's manual states: "Do not wait for the engine to warm up while the vehicle remains stationary. Start driving right away, but at moderate engine speeds. This is the fastest way for the cold engine to reach its operating temperature." Chevrolet Impala's (and other Chevrolets) 2014 manual states: "Avoid idling the engine for long periods of time."

Just two of many vehicle owner's manual sample pages listing various reasons to avoid unnecessary idling — as seen on a dedicated page of the Idle-Free VT website — refuting misconceptions on allowing vehicles to idle — "straight from the horse's mouth". 🐾



AIR QUALITY INSIDE YOUR CAR

From EarthTalk®

The interior of your car may seem like a safe haven from air pollution, but it may actually be quite the opposite. Chemicals emanating from the steering wheel, dashboard, armrests and seats mix with the airborne pollution being generated under the hood to form a witch's brew of toxins for those riding inside.

"Research shows that vehicle interiors contain a unique cocktail of hundreds of toxic chemicals that off-gas in small, confined spaces," says Jeff Gearhart of the Ecology Center, a Michigan-based non-profit. The extreme air temperatures inside cars on sunny days can increase the concentration of volatile organic compounds (VOCs) and break other chemicals down into more toxic constituents. Some of the worst offenders include airborne bromine, chlorine, lead and other heavy metals. "Since these chemicals are not regulated in cars, consumers have no way of knowing the dangers they face," adds Gearhart.

Exhaust fumes also find their way

into the passenger cabins of many cars. The International Center for Technology Assessment (ICTA) found that concentrations of carbon monoxide (a noxious by-product of internal combustion known to cause headaches, dizziness, nausea and fatigue as well as being a major asthma trigger) may be 10 times higher inside any given car than outdoors along the roadside. ICTA added that in light of the fact that the average American spends an hour and a half driving around each day, in-car air pollution may pose "one of the greatest modern threats to human health."

To help consumers minimize their exposure, the Ecology Center released the fourth version of its Consumer Guide to Toxic Chemicals in Cars in 2012, comparing over 200 different cars across the 2010 and 2011 model years. Those scoring the highest in regard to interior air quality include the Honda Civic, Toyota Prius and Honda CR-Z. The Civic scored first by being free of bromine-based flame retardants (BFRs) in interior

Cont. on page 6



The Ecology Center's 2012 Consumer Guide to Toxic Chemicals in Cars compared over 200 different cars across the 2010 and 2011 model years. Those scoring the most kudos in regard to interior air quality include the Honda Civic, Honda CR-Z and the Toyota Prius, pictured here. Photo Credit: Toyota

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2013 Honda Civic Hybrid
MPG*: 44 CITY 44 HWY
 (Automatic)

CIVIC

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MPG*: 35 CITY 39 HWY
 (CVT)

CR-Z





2013 Honda Insight Hybrid
MPG*: 41 CITY 44 HWY

INSIGHT

* Based on 2013 EPA mileage estimates. Use for comparison purposes only. Do not compare to models before 2008. Your actual mileage will vary depending on how you drive and maintain your vehicle.



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KING ARTHUR FLOUR IS TAKING 'CHARGE'!

G.E.T. Staff

Now those of us who drive electric vehicles (EVs) have an extra benefit when visiting the King Arthur Flour location in Norwich, Vermont. King Arthur Flour and Green Mountain Power have teamed up to provide visitors with an EV charging station.

Green Mountain Power's vice president for generation and energy innovation, Steve Costello, has supported EVs with the note that in Vermont, 47% of carbon emissions come from vehicles. If we are to reduce our global warming gasses, we will have to address the problem of releasing these greenhouse gasses, and switching to EVs is an obvious way to do that.

For their part, the leaders of King Arthur Flour have long since declared their position on social and environmental responsibility by registering as a Vermont Benefit Corporation, or B-Corp. They believe that by making a charging station available, they are helping people move

away from fossil fuel use and toward a healthier world.

One of the really great things about this particular charging station is that it is provided with electric from solar PVs in a 9.54 kW net-metered system. Electricity from the PVs that is not used to provide power for EVs will go on the grid for use elsewhere. Another implication is that the sun need not be shining for cars to plug in.

The system was installed by Same Sun of Vermont. The array of PVs is ground-mounted, installed on three poles, each holding a dozen solar panels. The \$51,900 system was built with the aid of a grant of \$17,500 from Green Mountain Power.

At the time the charging station was opened, there were only 282 EVs registered in Vermont, but the number had grown 220% in the previous year. Considering the rate of growth, it is highly likely that the charging station will be used quite a lot, very soon. ☺



Tesla charging at King Arthur's Flour's 9.45 kW charging station. Photo courtesy King Arthur's Flour.

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SMART COMMUTING IN NH & VT

Transportation emissions are among the worst offenders that add to the rising CO2 levels in our atmosphere. In recent months we have learned that our efforts have begun to reduce the detrimental air quality counts (NHDES), but as you may have learned from numerous other reports such as the International Panel on Climate Change (IPCC), <http://climatechange2013.org/>, global warming is still advancing faster than expected.

How do we get our emissions down now? By making New commuting choices!
LOTS OF CHOICES. Smart Commuting is all about knowing your options and planning ahead. There are many choices to get around in New Hampshire and Vermont. The first place to start in Vermont is “Go Vermont” for statewide choices to travel more efficiently. Whether getting around town, commuting to work or school, or planning a day trip, share the driving or ride with someone else to help save our planet and to save approx. \$2,000 annually. The statewide VT site also lists services for commuters, tourist, and shoppers.

In New Hampshire you’ll find a similar site at “NH Rideshare” where you can find carpools, transit routes and schedules, bike and walk trails and links to statewide transportation information.

When carpooling, remember to use the local Park n Ride lots to meet your connections. Start your trip planning at connectingcommuters.org or nh.gov/dot/programs/rideshare/ for statewide choices.

IN NEW HAMPSHIRE

UPPER VALLEY RIDESHARE (UVRS) - Carpool matching, benefits and support for commuters in/out of Upper Valley. 802-295-1824 x208. uppervalleyrideshare.com.

ADVANCE TRANSIT (AT) – Free weekday bus for Lebanon, Hanover, Enfield, Canaan, NH, and Norwich and Hartford, VT. Dartmouth and DHMC Shuttles. ADA Services. 802-295-1824. advancetransit.com CARROLL COUNTY TRANSIT - Services and connections to Belknap County. 888-997-2020 tccap.org/nct.htm

CITY EXPRESS - Serves Keene. 603-352-8494 hcsservices.org/services/transportation/cityExpress.php

COMMUNITY ALLIANCE TRANSPORTATION - Services for Claremont & Newport. 603-863-0003

CONCORD AREA TRANSIT (CAT) - Serves Concord 603-225-1989 concordareatransit.org

CONTOOCOOK VALLEY TRANSPORTATION (CVTC) - Monadnock Rideshare for the southwest region 877-428-2882 cvtc-nh.org

COOPERATIVE ALLIANCE FOR REGIONAL TRANSPORTATION (CART) - Serving the Chester, Derry, Hampstead, Londonderry, Salem and Windham, limited service to Plaistow. 603-434-3569 cart-rides.org

DARTMOUTH COACH - Services to Boston, Logan Airport and NYC 800-637-0123 dartmouthcoach.com

MANCHESTER TRANSIT AUTHORITY (MTA) - Manchester, with links to Nashua and Concord. 603-623-8801 mtabus.org/services/local-buses

NASHUA TRANSIT SYSTEM (NTS) - Buses and trolleys with bike racks. 603-888-0100 RideBigBlue.com

WINNIPESAUKEE TRANSIT SYSTEM (WTS) - Services Belmont, Franklin, Tilton, Laconia. 603-528-2496 bm-cap.org/wts.htm

IN VERMONT

UPPER VALLEY TRANSPORTATION MANAGEMENT ASSOCIATION (Vital Communities) - Works with UV employers and communities to promote and improve commuting options. 802-291-9100 vitalcommunities.org/transport/index.htm

VERMONT PUBLIC TRANSPORTATION PUBLIC TRANSIT - Lists transit, ferries and more at aot.state.vt.us/PublicTransit/providers.htm

AMTRAK - Long distance train service. Discounts for AAA members and student advantage card. (800) 872-7245 amtrak.com

CHITTENDEN COUNTY TRANSPORTATION AUTHORITY - Burlington bus service with links to Montpelier, Middlebury and commuter route to Milton. cctaride.org

CONNECTICUT RIVER TRANSIT - Services in Bellows Falls and Springfield. crtransit.org

GO VERMONT - Offers carpool matching and commuter connections in VT 800-685-7433 connectingcommuters.org

GREEN MOUNTAIN RAILROAD - Day trips from White River, Champlain Valley, Bellows Falls and Rutland. rails-vt.com

GREEN MOUNTAIN TRANSIT AGENCY - Local service in Barre, Montpelier, Grand Isle, Stowe and Lamoille. 802-223-7287 gmtaride.org

GREY HOUND/VERMONT TRANSIT - Long distance bus services. 1-800-231-2222 greyhound.com/

LAKE CHAMPLAIN FERRIES - Transport between New York and Vermont via Lake Champlain. 802-864-9804 ferries.com

MARBLE VALLEY REGIONAL TRANSIT- For Rutland, Killington, rural Manchester, Poultney and Rutland to Bellows Falls. City routes Free on Saturday. 802-773-3244 thebus.com/

RURAL COMMUNITY TRANSPORTATION (RCT) - Buses, vans, and volunteer drivers. Routes via The Jay-Lyn, The Highlander (Newport - Derby Line); The US RT2 Commuter (St. J. to Montpelier) and Free routes to rural areas. 802-748-8170 riderct.org

STAGE COACH - Buses from Randolph and Fairlee to Dartmouth, & local village. 800-427-3553 stagecoach-rides.org

IS THIS THE END OF PEAK OIL?

By George Harvey

Industrial Technology Research Institute (ITRI) made an announcement in late October that sounds like it could change the world. They are bringing a technology to market that makes butanol from cellulose. The thing that makes this special is that they claim the process doing this is carbon-negative. In other words, the process of making butanol actually takes more carbon dioxide out of the atmosphere than it puts in. Since cellulose feedstock is close to carbon-neutral, the butanol made from it is as well. And butanol is a liquid that can be used as a fuel. ITRI is one of the most prestigious research facilities in the world, so I think we can take this claim seriously.

There are a number of things about this claim that are worth thinking about. One is that, like ethanol, butanol can be mixed with gasoline for automotive fuel. Butanol has a number of advantages over ethanol, however. It is made from cellulose, which can be derived from just about any plant material, including agricultural, forestry, and food waste. By contrast, most ethanol comes from sugar, and in North America is usually made from corn. Butanol has more energy than ethanol, and so will provide better gas mileage. In addition, butanol will not harm an engine if the mix is greater than 10%, while the ethanol mix of 15% is considered problematic. In fact some vehicle engines run on straight butanol without modification, and those that cannot, might be converted for it at relatively low cost.

According to the ITRI press release, transportation fuel made from butanol could cost as low as \$2 per gallon. We might note that the cost of extracting oil from shale just happens to be about \$2 per gallon, and this oil has to be transported, refined, transported again, and sold, with a markup for each step.

Butanol can also be used as feedstock for a large number of chemicals. It is probable that nearly anything that can be made from petroleum could

be made from butanol. This includes anything from plastics to paint solvents, from adhesives to detergents.

In bringing their product to market, ITRI is not building production facilities and developing a marketing network. What the organization is doing instead is licensing the technology to companies that are capable of using it.

The effect of using this product will be profound, if it turns out to be as claimed. Switching from the ethanol currently used in gasoline to bio-butanol would, by itself, reduce the US carbon emissions by 60 million tons per year. As greater quantities become available, we could decrease our carbon emissions by greater amounts.

There is a catch that ITRI did not mention. While it is true that if this works out, we will be able to reduce some carbon emissions easily, it is not true that we can simply go on wasting resources and get away with it. Cellulose has to come from somewhere, and though a lot can come from waste from paper, forestry, farming, and industry, it remains to be seen how much we butanol we can get from these sources. We can grow plants for the purpose, but we will have to do this in a sustainable manner. But the real catch is that we will probably never be able to replace the amount of oil we consume with biologically produced products. We must do more.

One thing is certain. If this process is both feasible and “scalable,” then the rising price of oil is surpassing the cost of replacing it with renewable products. As that happens, oil production will decline, not because sources are running out, and not because we have to abandon oil to prevent worsening global warming, but because oil will have effective competition from alternative, renewable fuel sources that cost less. When that happens, we are past “peak oil,” and we witness the decline of the oil industry. The good news of this scenario is that we do not have to be in want if we simply conserve. ♻

CONTINUED GLOBAL WARMING AFTER CO2 EMISSIONS STOPPAGE

A new study by Princeton University researchers says the carbon dioxide already present in the Earth’s atmosphere will cause continued global warming for decades after emissions stop.

- From nature.com <http://bit.ly/1aJYeZJ>

AIR QUALITY INSIDE YOUR CAR

Cont. from page 4

components, utilizing polyvinyl chloride (PVC)-free interior fabrics and trim, and having low levels of heavy metals.

Meanwhile, pulling up the rear were Mitsubishi’s Outlander Sport, the Chrysler 200 SC and the Kia Soul. The Outlander finished in last place due to its use of BFRs as well as antimony-based flame retardants in its interior, chromium-treated leather components and excessive amounts of lead in seating materials.

“The good news is overall vehicle ratings are improving,” reports the Ecology Center, adding that the top performers have gotten rid of BFRs and PVC altogether in their interiors. “Today, 17% of new vehicles have PVC-free interiors and 60% are produced without BFRs.”

Consumers can check on their late model car by steering their web browser to the HealthyStuff.org website, the Ecology Center’s free online resource for consumer information. While environmental and public health groups are working to try to get automakers to clean up their interiors, individuals can reduce their exposure by parking in the shade, using interior sun reflectors to keep temperatures down inside the car and rolling down the windows to let the fresh air in.

Contacts: Ecology Center, www.ecocenter.org; ICTA, www.icta.org; Model Year 2011/2012 Guide to New Vehicles, www.healthystuff.org/documents/2012_Cars.pdf.

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FRACKING IS FRACKING

By N. R. Mallery and G. H. Harvey

Fracking or hydraulic fracturing is a method of freeing oil and gas from the tight grip of some deep wells by fracturing whole rock formations. It has been associated with a number of problems, including destruction of aquifers that bring water to wells and springs, destroying the quality of many of the wells and springs by polluting them, causing earthquakes, and releasing large amounts of methane into the atmosphere.

The overall and final effects are not completely understood. One clear result is that fracking destroys the land for these drilling sites, permanently. Studies from such organizations as Princeton University and the US government do show more than enough reasons that this is clearly not an option we should be using.

Vermont banned fracking in 2012, but the state did not ban use of natural gas, some of which comes from fracked wells. To make matters more complicated, natu-

hopes to reduce its use of oil by 640,000 gallons per year. By using the pipeline, the college hopes to eliminate the need to truck gas from the digesters to the campus.

The natural gas, fracked or not, will also allow homes and businesses to convert from other, more costly – and more carbon intense – fuels, reducing their carbon footprint. It will not eliminate the carbon footprint, but it will reduce it. If it comes from fracked wells, it might do as much harm as good.

We have questions. Should we oppose fracking everywhere, or should we use fracked gas to reduce our carbon footprint here in Vermont? Should we oppose the pipeline?

We at Green Energy Times oppose fracking absolutely, regardless of where it is done. We oppose the use of natural gas because it is a fossil fuel that contributes to climate change, though we must acknowledge that the change from oil



This is what fracking does to the land.

ral gas pipelines are being laid from South Burlington to Middlebury and Vergennes, and from there to Ticonderoga, New York.

The new pipeline, which could carry gas from fracked wells in other states and Canada, leads us to a dilemma. Now that we have banned fracking in Vermont, should we buy gas produced by this process in other areas? Unfortunately, a closer look at the dilemma makes the answer appear less clear.

We might take the actions of Middlebury College as exemplifying the problems. Middlebury seems to be supporting the pipeline. This does not mean that the college supports fracking, however, or even the use of natural gas. The same pipeline that carries natural gas from out of state can carry bio-methane from digesters located some miles from the college. By using bio-methane, the college



Fracked water: don't do this at home!

or coal to natural gas is better than no change at all. As to pipelines, the day may come when they carry bio-gas or synthesis gas, with very little negative effect.

We have to keep working, but we believe that the best places to putting our efforts are to replace the sources of fuels, moving from fossil fuels to renewables, with as much as possible coming from local sources. This is one of the important steps to lead us into a sustainable future and energy independence with clean, renewable energy sources. ♡

THE 2014 LEGISLATIVE LANDSCAPE ON ENERGY ISSUES

By Johanna Miller

The 2014 legislative session is right around the corner and lawmakers are likely to consider several important energy issues, including funding weatherization and heating efficiency programs for low-income residents, fixing the state's successful, but currently threatened, net metering program and assuring the continued financial stability of the Clean Energy Development Fund. People who care about positive action on clean energy should closely follow legislative efforts this year and beyond. As always, what happens — or does not — under the Golden Dome will take us forward or set us back on clean energy and climate-action solutions.

A few energy issues likely on this year's agenda include:

1. How and Whether to Fund Weatherization Programs. The state set a goal to weatherize 80,000 homes by 2020. Unfortunately, at current investment levels, Vermont is on a trajectory to miss that goal by half. This means many Vermonters will hemorrhage heat out of their leaky homes, squeezing already tight budgets. A real commitment to heating efficiency in Vermont is essential. At the least, in 2014, finding sufficient funding for the low-income weatherization program is imperative before current funding levels fall off and weatherization agencies are forced to lay off workers and cut the number of Vermonters they can help in 2015.

2. Find a Fix for Net Metering. Net metering is Vermont's most successful renewable energy program, allowing Vermonters to generate their own clean, local power. Here is the rub, though: currently, there is a statutory cap on net-metered projects. This means that many Vermonters who want to go solar can't do so because some utilities are no longer required to accept — and are no longer taking — net-metered customers.

This roadblock is keeping many Vermont families, schools, municipalities and businesses from installing solar systems, it's slowing down larger-scale investments in clean energy and it's creating uncertainty in an already-stressed investor market. Lawmakers are poised to consider this issue, and it's hoped that they will support some promising solutions, such as:

- Exempting residential systems under 15kW from counting towards any cap.
- Raising the cap for projects over 15kW to 15 percent.



The Vermont State House, photo by John Phelan.

• Maintaining the current or a similar incentive structure for net-metered projects.

3. Clarify Municipal Taxation of Solar Projects. In 2012, the Legislature established a state education property tax of \$4/kW of capacity for solar projects over 10 kW. How towns should assess the value of solar projects for municipal property tax purposes has been unclear, however, and municipalities are doing it differently. This has created confusion, unintended consequences and added more uncertainty for people trying to develop homegrown renewable electricity. A simple, predictable and affordable solution is needed to facilitate homes, businesses, schools and towns going solar.

4. Fund the Clean Energy Development Fund. The CEDF has been in place for 10 years, effectively stimulating investment in small-scale renewable energy and providing funding for certifying solar installers. Funding for the CEDF has been uncertain and uneven over the years and, at this time, no source of funding has been identified for it next year. Without action, this important small-scale, clean energy-catalyzing fund could be eliminated altogether. Finding funding for this program is pivotal.

Vermont set important statutory goals of cutting our greenhouse gas emissions 75 percent by 2050 and getting 90 percent of all our energy from renewable sources by 2050. As a nation, and as a state, getting off of fossil fuels as quickly, seamlessly and affordably as possible is imperative for long-term economic security and the stability of the global climate. That will require increasing efforts to reduce energy consumption and, simultaneously, increasing the diversity and distribution of clean, renewable energy resources. These and other important legislative initiatives in 2014 and beyond are essential to charting that course.

For more information and to get involved, visit www.vnrc.org or contact VNRC's Energy Program Director Johanna Miller at jmiller@vnrc.org or 802-223-2328 ext. 112. ♡

of having air-source heat pumps, he adds, "Mainly we had them installed to provide air conditioning in the summer and to solve a downstairs humidity problem."

Tony chose Cacicio Heating in East Montpelier to install Mitsubishi "Mr. Slim" units for the lower floor of his ranch house and two upstairs rooms. He said the cost of the units was about \$8,000. Noting that there were no incentives to apply to

their purchase, he added, "If I were a GMP customer there would have been incentives."

He expects to cut his propane heat cost by 70% and electricity bill to increase by 20-25%. These figures would produce a net savings of over \$1,000 per year.

"I couldn't begin to tell you the science behind it," Tony says. But he adds, "So far the house is way more comfortable." ♡

Cut Your Heating Bills In Half

Cont. from page 1

One person who has looked into heat pumps and decided to install them in his house is Tony Klein, Vermont State Representative for East Montpelier and Middlesex, Vermont. Since he is the Chairman of the House Natural Resources and

Energy Committee and the Joint House and Senate Energy Oversight Committee, we imagine he did his homework on the subject.

Tony says, "I am convinced that heat pumps will substantially lower my cost of heating this winter." Noting side benefits

GRANITE STATE SOLAR EXPLAINS HOW AFFORDABLE SOLAR IS IN NH!

By G.E.T. Staff

Granite State Solar was founded in 2008 by Alan Gauntt, whose background includes both large-scale commercial and residential renewable energy systems. Now, Teri Gauntt, Alan's wife, has joined him in the business as the business manager. The family-owned and operated solar installation business is based in Sutton NH near Lake Sunapee, and serves the entire state of New Hampshire.

Teri says, "Residents are starting to pay attention. Electricity rates are on the rise, but the good news is that due to incentives and rebates, the cost of installing residential solar systems has never been more affordable." Until now, Granite Staters just haven't realized how affordable PV solar can be, and the recent drop in the cost of solar equipment makes it more affordable for NH homeowners than ever before. The result is that the solar company spends much time teaching others the benefits and affordability of being green through solar energy.

Residents are entitled to receive a 30% tax incentive from the Federal Government. Additionally, the Public Utilities Commission of NH offers a rebate of up to \$3,750. And, for those individuals with

New Hampshire Electric Co-Op they may qualify for an additional \$2,500!

Sustainable energy is one of the safest investments a homeowner can make, and this is true for many reasons. "The sun will continue to shine, making solar a proven and reliable resource for the future," Gauntt points out, "and what many people don't realize is that there is zero-down financing available to assist homeowners with the purchase a solar system that will equal less than the amount of their monthly electric bill, allowing people to feel better about their future both financially and environmentally." The result is an increase in demand, and people are noticing new solar panels going up all around in the communities across the state, as the solar industry in New Hampshire responds to that demand.

Recently, GSS installed a photovoltaic solar system for a customer on a home in Campton NH. The customer had to repair the roof and decided to invest in solar at the same time, adding increased value to his home. They installed a 7.35 kW system consisting of 30 Canadian Solar 255W Monosilicon Panels on the roof of the garage.

"We project this system will produce about 9,082 kilowatt hours of electricity



A Granite State Solar installation in Wilnot, New Hampshire.

each year. It included 30 Enphase 215 Micro Inverters, and an Enphase real time monitoring system to track usage for the homeowner. This resident achieved an increased value in his home overnight while seeing instant cash savings on his electricity bill each month," Teri Gauntt says.

"With all the compelling reasons for NH homeowners to acquire a solar power system, NH is certainly on the verge of something great and we are so glad our family to be a part of it!"

Granite State Solar's website is at www.GraniteStateSolar.com.

8



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ENCOURAGING ENERGY NEWS.

The Lego Group, Danish manufacturer of Lego Toys, has signed an agreement with the WWF to work with suppliers and reduce its impact on the environment. One of its targets is to be powered 100% by renewable energy, producing more renewable energy than it uses in its facilities, by 2016.

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US SOLAR TESTING CENTER IN VERMONT

GET Staff Article

On November 4, Sen. Bernie Sanders, Gov. Peter Shumlin, and representatives of IBM, Sandia National Laboratories, and the US Department of Energy launched the Vermont Photovoltaic Regional Test Center in Williston, Vermont. The center will be used for research on cutting costs of solar power and integrating solar energy into the state's grid.

Funding of \$3 million for the project is being provided by the US DOE's SunShot Initiative. The initiative's goal is to reduce the cost of solar energy by 75% by 2020 and make solar power provide at least 15% of America's electricity 2030.

The Regional Test Center is one of five such centers being opened to evaluate solar photovoltaic systems, collecting data from actual installations. The data will help with determining the effectiveness

of systems in varying weather conditions, such as Vermont's relatively harsh winters and limited sunshine.

Bernie Sanders said, "We have a bold vision here in Vermont and across the country for an energy transformation phasing fossil fuels out as quickly as possible in favor of clean, renewable energy. People understand that solar has huge potential to reduce greenhouse gas emissions and create good jobs."

Governor Shumlin added, "Vermont will be playing a leading role in critical research and development to advance clean solar power." He pointed out that Vermont has more green jobs per capita than any other state.

IBM will host the center at their Williston, Vermont campus. The facility itself will have up to 300 kW of capacity.

Connecticut is pushing aggressively to expand solar energy to homes across the state. In the past 22 months, 2,160 residential solar systems contracts have been approved.



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SOLAR RETURN ON INVESTMENT IN NEW ENGLAND - ONE OF THE BEST INVESTMENTS YOU CAN MAKE!

By George Harvey

Okay. Let's forget that the big reason to install solar photovoltaic is that it is good for the world, good for the environment, good for the future of humanity and your cost of living. It is, but let's forget that for now. And let's forget that PV lowers electric bills and adds value to your house, even though it does. Let's see how solar

PV really is an investment of the type an investment manager might make, by making comparisons to the sorts of investment that go into a mutual fund, pension fund, or retirement portfolio.

Part of the problem of calculating the value of a solar investment is that it

Cont. on page 12

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SOLAR GROWTH IN 2013

Cont. from page 1

New Hampshire

New Hampshire has historically lagged behind Massachusetts and Vermont in solar installations, because the state still does not prioritize solar power. The Renewable Energy Standard requires a minimum of 24.8% of all power from renewable sources by 2025, but only anticipates 0.3% coming from solar. Nevertheless, New Hampshire does have a good incentive program, and we expect solar



Part of the 100kW solar array at the Exeter, New Hampshire High School. Photo by SayCheeeeeee

to become more common in the Granite State in the near future.

The largest solar array in New Hampshire is probably a 525 kW system on the roof of a parking garage at Man-



David Greer, with the 99.5kW rooftop solar system on his company, Wirebelt of America, says "I just love the stuff!"

situation. Plus, I just love the stuff!"

Vermont


There are over 3,300 net-metered systems in Vermont. There is a 2.2 MW cap to the size of qualifying systems, though nearly all are much smaller than that. The combined capacity of the net-metered systems is 34,650 kW, a figure that dwarfs all of the largest arrays in New England.

The Vermont SPEED program lists nine solar arrays of 1 MW or larger, and seven of these are listed as being 2.2 MW, one being the South Burlington Solar Farm. More arrays of this size or slightly larger are coming on-line including a number of new systems in Rutland alone. Integrated Solar is building a 2 MW array in Brattleboro.

SunGen1 in Sharon was 2.2 MW, but had more added and now is 3 MW or larger. Other, larger arrays are in the works. The Vermont Electric Cooperative has announced that it intends to build a 5 MW system in its territory.

The Overall Picture

It seems that no matter how big a solar system is, there is another, larger one in the works. And solar systems get installed so quickly, that it is hard to keep track of what is finished and what is on the way. Clearly, however, most of the solar PV capacity is in small rooftop systems added together. It might be fair to say the largest system of PVs consists of a distributed combination of all the small ones.

Solar power does not yet supply more than 1% of our demand, but its rate of growth is astonishing, often as high as 65% or more per year. It is clear that solar will be a major factor in our power capacity within this decade. 

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chester Airport. Among other installations, a 127 kW system at Keene State College is matched by one of the same size at Colby Sawyer.

Many installers have been hard at work. Clay Mitchell of Revolution Energy in Portsmouth told us they had built a number of solar systems, including a 141 kW array at a Favorite Foods store in North Conway and a 100 kW system at Exeter High School. Craig Bell of Solar Source in Keene expects there may be up to several hundred kW's of solar installed by his company in 2014. PAREI has put up over 60 rooftop arrays, totaling over 270 kW.

Many New Hampshire businesses have turned to solar out of sheer passion for renewable energy. An example is Wire Belt Company of America, in Londonderry, whose solar productivity and energy efficiency is ever-increasing. Their 2010 rooftop solar installation totaling 99.3 kW is currently being considered for expansion on their recent energy efficient addition. The owner, David Greer, explained, "It is a way to help our country's economic

SOLARIZING THE UPPER VALLEY

By Sarah Simonds

Communities and solar installers across the Upper Valley of Vermont and New Hampshire are teaming up with local non-profit Vital Communities to help Upper Valley residents go solar.

Solarize Upper Valley is a new program designed to make residential solar photovoltaic (PV) systems more accessible and affordable. The concept is simple: community-driven outreach will help lower customer acquisition costs for participating installers, who will then transfer those savings on to customers. The goal: at least double the amount of solar in each participating community and strengthen the market for solar PV across the Upper Valley region.

Each round of Solarize Upper Valley will feature a 15-week outreach campaign, with the first launching in mid-March 2014. Solarize outreach efforts will be led by teams of community volunteers, called Solar Ambassadors, with support from Vital Communities staff. The first group of Solarize communities will be announced in January.

Solarize Upper Valley is designed to address several common barriers to going solar.

Going it alone in the solar market can be a complex and uncertain experience for customers. To help address this, Solarize communities will each carefully select a partner solar installer and, with the help of Vital Communities and an independent technical advisor, vet the technology and pricing to be offered throughout the Solarize campaign. The first round of Solarize communities will accept bids from installers through mid-February, primarily from installers based right here in the Upper Valley.

Customers want to hear from people

Cont. on page 25



Community energy leaders gathered in November to learn about becoming 'Solarize' communities this spring. Photo Credit: Emily Gardner, Vital Communities

Cont. on page 25

MAKING YOUR DECISION TO 'GO SOLAR'

By Khanti Munro

Solar is too expensive. How do I justify the cost?

A common misconception about going solar, for financial institutions and homeowners alike, is that investing in a solar-electric system only adds additional debt. The reality is that when financed, your new electric bill is the financing cost, and it replaces the old bill. You may still have a small service charge left on your monthly electric bill, but that will be it.

Your solar system financing should be lower than your current electric bill. When it is paid off in ten years or less, you have another twenty or more years of free energy.

When you finance a solar system, you are making a commitment, so it may feel like you have a large upfront cost, but your overall monthly payments go down immediately, compared to what your electric bill was -- and then it goes away altogether.

Banks are now realizing solar isn't some 'hippy-dippy' left-field alternative, but a robust home improvement worthy of financing. They also understand the cost of NOT going solar. Even assuming a conservative average 2-3% annual increase in your utility rates, without solar it will be more than double the cost of a new solar system.

Can I do this? Where does one start? How much will it would cost?

First, estimate the size of a solar-electric system that you will need, based on your current annual energy consumption, in kilowatt-hours (kWh). Do this by looking at your last 12 months of electric bills. You can also call and ask your utility for the information, or go to their web site.

Then you do a little math. Here in the Northeast, a 1-kilowatt (kW) system will generate approximately 1000 to 1200 kWh each year, with variation based on site conditions. Divide the number of kWh/year by about 1100 to get the system size you need. An example, if you use 8800 kWh/year, you would need an 8-kW solar-electric system. This is a large system!

With current installation costs running at around \$4-5/watt, installed, that makes the approximate 'pre-incentives' cost for the 8-kW system around \$32-40K. But incentives, which vary based on where you are, can reduce this cost by anywhere from 30-70%. In this case, that translates to about \$16-20K, to be financed for the cost of a solar installation over ten years, though the equipment will last years longer.

You should compare this to the cost of NOT going solar, if you continue buying electricity. For 8,800 kWh/year, assuming a cost of \$0.14/kWh, along with about a \$15/month service charge, and a conservative annual utility rate hike of 2.5%, over a 25-year period, purchased electric costs would be around \$50K!

What about a solar site? What if I don't have a good site?

A good solar site is free from shade, from at least 9 am to 3 pm, year round, and faces somewhere between Southeast and Southwest. For a roof mount, the ideal southern facing roof plane would have a compass bearing of approximately 180°, and a pitch of 25-35° (6:12 to 8:12). It would ideally be composed of asphalt shingles or standing seam metal, though some other types of roofs can be used.



A complete solar array.



A ground mounted solar array at a school, with a shed for the inverter.

A ground mount provides more flexibility for siting, as you can typically locate it on your property where you get the most daily/annual sun, and face it 'true-south' with either the ideal fixed tilt, or use a tilt-adjustable rack. But you need to be sure a ground mount won't compete for existing land-use.

And remember, a full shade analysis using specialized equipment is important.

Vermonters who live on property with no shade-free areas, or live in rented homes, can still get solar systems. Vermont is one the few states with a provision for group net metering, which allows cooperative ownership of a solar-electric system located remotely from your home. The result has been an emergence of energy co-op's and co-owned systems. The utility billing department credits your personal electric

account, based on your ownership share and corresponding solar energy production of the system. For more information on group net metering, contact your local utility and/or solar installer.

But Solar only produces power in the daytime!



A solar powered dental office with a Tracking system that follows the sun during the day, for maximum production.



A residential rooftop solar array.

power not consumed by your home is sold to the utility and credited to your account.

The majority of solar-electric systems installed today are grid-tied systems, and most have no storage batteries. When the sun shines, the solar modules produce power, and any excess power, and any excess power you use comes from the utility, and your account is billed. If you are making the same amount of power you consume, the prices cancel each other out.

In effect, the electric grid serves as battery, banking the excess power during the day, and

sending some of it back when the sun is not shining and power is needed. The newly installed net-meter on your house keeps track of energy in and energy out. Your electric utility then settles up with you each month, and at the end of your 12-month billing cycle.

It's important to know however that in a batteryless grid-tied system, when the grid goes down, your solar system will also shut off. This is because without backup batteries in the home to provide a steady voltage reference, the electronics in the system cannot continue to operate in a safe and efficient manner. If backup power is required in areas with frequent utility outages, or if you have critical needs such as medical purposes, then batteries can be used in the home solar-electric system.

How much of my energy needs will it cover?

A solar-electric system can be designed to meet all of, or just a portion of your annual energy consumption, based in part on your budget and mounting space. With proper forethought, solar can even be modular in design, and thus does not need to be installed all at once, which can be helpful in breaking up the costs, though costs are somewhat increased.

What will it do for our planet and carbon footprint?

Solar power will certainly reduce your environmental footprint. Here in the Northeast, every kWh of traditional fossil-based energy our homes consume causes a release of about 0.75 to 1.5 lbs of carbon dioxide (CO₂). A typically sized 7 kW (26 panels) solar system will generate approximately 192,000 kWh during a 25-year warranty period, and reduces your carbon emissions by 144,000 to 288,000 lbs! Assuming the average Northern hardwood tree absorbs around a ton of CO₂ in an average lifespan, that means this same system has the approximate carbon sequestering impact of no less than 72 trees!

By producing your own clean energy onsite, the external environmental costs of drilling, fracking, damming and burning fossil sources for energy are avoided. Every kWh produced on your own roof is one more reason not to drill in a wildlife refuge in Alaska, or send our money overseas to unstable governments in return for irreplaceable fossil energy sources.

What's the bottom line?

Solar is exciting because it offers something we are not accustomed to having: a choice between buying a commodity and making it ourselves. Historically, solar hasn't been able to compete with its heavily subsidized fossil counterparts, but that is changing. Over the past few years, the cost of solar equipment has dropped more than 50%, making the long-term costs of solar actually lower than your current electric bill. Solar is not the only solution, nor will it be feasible for everyone; but in the end it is one solid way to save money and tread a little more lightly on the environment.

Khanti Munro is the VP of solar operations at Positive Energy, an owner-operated construction company specializing in the installation of residential and commercial solar projects, along with general construction, crane service, and excavation. The company has two NABCEP PV Installation Professionals on staff. If they complete what they hope to complete, Positive Energy is on target to have installed 500kW in 2013! PositiveEnergyNY.com

SOLAR Q&A

**SOLAR UNCERTAINTY**
with Howie Michaelson, Catamount Solar

Howie Michaelson (who has lived in a solar, off-grid home for 14 years) answers solar related questions in a simple, clear fashion. Submit your questions to G.E.T. or uncertain@catamountsolar.com for inclusion in future editions!

Q: My partner wants to put our new solar panels on the barn roof because it is safer and better looking there. I have always heard that it is better to put it on a ground rack so we can clear snow and adjust the angle.

Who is right?

A: There are plusses and minuses to roof and ground mounting options, so you could say you are both right, both wrong, or (being more political) somewhere in between. Here is a list of many of the issues you might face when making this decision.


•Roof-mounted systems are typically less expensive than ground-mounted systems, simply for the reason that with roof-mounted systems, the structure for holding the solar rack is already built – the roof itself. Ground-mounted racks need a substantial structure built to hold them in place. It is as important to hold the rack down – think high winds blowing against that nice “solar sail” of ground-mounted panels.. (If you have any doubts or concerns about the loads that solar applications might add to a roof, or structure, consult a qualified engineer).

•Some folks enjoy the look of a solar array in their field where they can see it and appreciate it (and perhaps show it off), but many others would rather the array fit more unobtrusively into their landscape by “hiding” it on a south-facing roof.

•While roof systems are less expensive, and perhaps generally accepted as more aesthetically pleasing, many

people do not have a largely unshaded, reasonably south-facing roof to donate to the project, leaving them with a more easily sited south-facing ground mounted array as the best option.

•Grid-tied, net metered solar systems produce the bulk of their electricity in the sunnier half of the year, so they are not overly sensitive to lost wintertime production due to snow covering the array. However, off-grid systems are trying to maximize wintertime production and therefore benefit from as little snow coverage as is feasible. Ground-mounted arrays (particularly top-of-pole-mounted rack systems) are seasonably adjustable to maximize production year round. They can allow for a steep wintertime tilt in order to minimize snow collection, and are more accessible for careful manual snow clearing when necessary. Roof-mounted systems are often harder to reach and at a pitch that doesn’t shed snow as quickly as might be desired in off-grid situations. Therefore, ground mounts are often the rack of choice for off-grid systems.

So as noted above, there is no a simple answer to the question of where to put a solar array. The answer, as is so often the case, is “It depends!” Your solar installer should be happy to go over the options available to you, discussing the advantages and disadvantages to each. In the end, of course, you can make the final decision, based on your own needs and aesthetic concerns. And it never hurts to get a second professional opinion when making such a significant financial investment. 

SOLAR RETURN ON INVESTMENT IN NE

Cont. from page 9

depends a lot on the siting of the solar system. Just about any solar installer can give advice on this. Another part of the problem is that the return on investment (ROI) of solar installations depends on what might be termed local factors: the state incentives at the place of installation, the local cost of solar systems, and the local cost of electricity that the solar system avoids.


One important investment for comparison is the S&P 500 Index, which has historically had an ROI of 9.9%, but there is no guarantee it will continue to grow at that rate. Another important investment is 30-year US Treasury bonds, which have had an ROI of 3.7%, on average. A third figure is the 0.75% return of a five-year Certificate of Deposit (CD), which is considered pretty secure.

This leads us to ask, how do these numbers compare with the ROI of a solar system in our states? There is a nice website with a page telling us just about all we might want to know: costofsolar.com/solar-roi/. The folks who put this site up have given us data on states in the US, including the following for our area:

ROI	State
17%	New York
16%	Connecticut
15%	Massachusetts
6.6%	New Hampshire
5.6%	Vermont
4.8%	Rhode Island
4.4%	Maine

We might note that solar systems in all these states have ROIs that are far better than a 5-year CD, all have ROIs that are significantly better than 30-year US Treasury bonds, and three have ROIs that are significantly better than the average ROI of the S&P 500. These facts do not tell the whole story, however.

The calculations leading to these results included the local factors listed above, but they did not include some significant facts. First off, adding a solar application to a property increases its value, and that increase is not considered in the calculation. Second, after the investment for solar is paid off, the solar system will continue to operate, providing free electricity, a huge cost savings and reduction to your cost of living, and this usually continues for a very long time – even into a person’s retirement. All of these add great value to solar.

Our conclusion is clear: if you are planning retirement, include solar in your calculations. It is one of the best investments you can make. 

Vermont to Work with Four Other NE States and Clean Energy States Alliance to Reduce Solar Costs

Multi-State Collaboration Awarded \$1.5 million from U.S. DOE

Montpelier, Vermont

The Public Service Department (PSD) announced on November 14, 2013 that it would participate in a regional effort targeting non-hardware “soft” costs for photovoltaic (PV) electricity systems and increasing coordination across Connecticut, Massachusetts, New Hampshire, Rhode Island, and Vermont. Clean Energy States Alliance (CESA), a national nonprofit organization that works with state and federal agencies, industry leaders, and other stakeholders to promote renewable energy and energy efficiency, will coordinate the initiative, which has been awarded \$1.5 million under the U.S. Department of Energy (DOE) SunShot Initiative Rooftop Solar Challenge II program.

The PSD will be the lead agency for Vermont’s involvement in this project. “Vermont has succeeded dramatically in deploying solar energy, and we are excited to work with other New England states to build on this success and work to further lower the cost of solar energy in our region” said Christopher Recchia, Commissioner of the VT PSD.

In addition to the Vermont Public Service Department, the lead state agencies participating are Connecticut’s Clean Energy Finance and Investment Authority, the Massachusetts Department of Energy Resources, the New Hampshire Office of Energy and Planning, and the Rhode Island Office of Energy Resources.

The Rooftop Solar Challenge II incentivizes teams to make it easier and more affordable for Americans to “go solar” through competitively awarded funding. By streamlining permit processes, updating planning and zoning codes, improving standards for connecting solar power to the electric grid, and


increasing access to financing, teams will clear a path for rapid expansion of solar energy and serve as models for other communities across the nation. The Rooftop Solar Challenge II is part of the SunShot Initiative, which strives to make solar-generated electricity fully cost-competitive with other sources of electricity by the end of the decade.

The New England Solar Cost-Reduction Partnership will help strengthen the solar market in the five-state region with 13 million residents. The partnership will refine and deploy innovations developed in Connecticut and Massachusetts for DOE’s Rooftop Solar Challenge I, and will more widely implement solar best practices from across the region.

Under this award, the PSD and the four other states will tackle a range of barriers to PV deployment, including permitting and connection challenges; the need for new financing tools; and planning and zoning rule variations.

“Information-sharing among the states and better understanding of the needs of stakeholders will help us identify efficiencies, potential collaborative activities, and opportunities for reducing soft costs,” said Warren Leon, Executive Director of CESA. “These states are all committed to the common goals of reducing the cost of solar electricity and building a strong regional market. We are excited to be partnering with them for this project.”

Municipalities, state agencies, major utilities, and other stakeholders across the four states will be key participants in the project.

Contact: Andrew Perchlik, Public Service Dept.
802-828-4017 andrew.perchlik@state.vt.us 


SOLAR IS A GREAT BUSINESS INVESTMENT IN VERMONT!

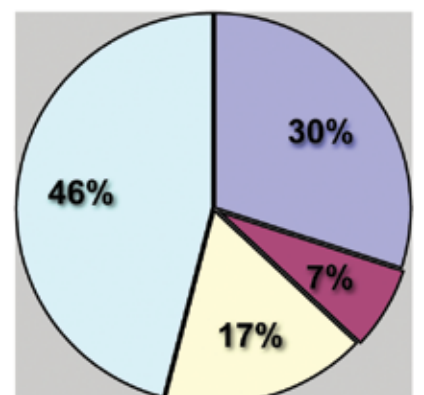
Private businesses are often not able to look very long term for return on their investments. In this environment, investing in solar makes great business sense! Tax benefits are available to businesses that can pay for more than half of the system cost. This, in combination with recent changes to Vermont laws that mandate the benefits utilities must provide to business-owned solar systems, can provide for a five- to seven- year payback for business-owned solar systems. The life of a solar system is typically 30-plus years. Systems require little to no maintenance or repairs over their life. So, this provides many years of essentially free power after the investment is paid off!





Island Excavating Corporation, from Grand Isle, Vermont took advantage of the the tax benefits when they decided to go solar.

“After consulting with DC Energy and our accountant about a solar array for our business, we discovered that the tax benefits would pay for more than half of the system. This made ‘going solar’ an easy choice. We are extremely happy with the outcome, and the professionalism shown by DC Energy was outstand-

ing,” said Dolly Parizo, Island Excavating Corporation. See Green Energy Times, October, 2013, page 8, for the full story.

Reprinted with permission from Ben Gordesky, DC Energy Innovations of Burlington and North Hero, Vermont. 

Business Tax Benefits Available

-  Federal Tax Credit 30%
-  VT Solar Tax Credit 7%
-  Accelerated Depreciation 17%
-  Your Net Cost 46%

2013 COMMUNITY SOLAR UPDATES

By N. R. Mallery

The Putney Community Solar Garden



The Solar Garden's Grand Opening on August 13, 2013. Pictured are panel owners, staff from SunFarm, Integrated Solar, the Clean Energy Collective and GMP.

The Putney Community Solar Garden went online August 23, 2013. It is Vermont's first community-owned solar garden -- a collaborative effort among SunFarm Community Solar, a Putney based solar organizer; the Clean Energy Collective, which handled financing, permitting, and legal matters; and Integrated Solar, a Brattleboro-based firm tasked with array construction.

The 144 kW project includes 576 Hanwha 250-watt photovoltaic panels, 24 Sunny Boy inverters and is mounted on a Schletter FS fixed racking system.

There are 49 Homes and businesses involved. From August 23 to October 24, 2013, the system produced 39,815 kWh of energy and offset approximately 62,000 lbs. of CO₂ during this period.

Expectations

- This solar garden is expected to produce roughly 180,000kWh of clean renewable energy per year.
- The expected payback is between 10.5 and 12 years.
- The system is expected to reduce carbon emissions by 280,000 lbs. per year based on the EPA average of non-baseload electricity generation emissions factor of 7.05×10^{-4} metric tons CO₂/kWh.

Projections

- Projected system lifetime: approximately 35 years
- Projected lifetime output: 7,650,000 kWh
- Projected lifetime reduction in power cost: \$3,950,000

Future

Nick Ziter, owner of SunFarm Community Solar announced, "We're working to develop three more projects of this size over the next year which will serve anyone in GMP territory, including former CVPS customers." The community-owned solar gardens allow individuals, home and business owners, renters and non-profits a chance to own solar panels and receive all the same benefits as those with individual systems.

For more information on the Putney Solar Garden visit www.VTSolarGardens.com, email info@VTSolarGardens.com or call (802) 536-4471.



The Putney, Vermont Community Solar Garden.

Coyote Ridge Community Solar, Westford, VT

Coyote Ridge Community Solar - a community solar project for three households in Westford, Vermont - was completed in October, 2013. It was designed and installed by DC Energy Innovations of North Hero VT and Burlington. This ground-mounted system was installed using individual micro-inverters so that the system can be expanded easily in the future, as the participants find more people to join them. It is secured with custom-made ballast blocks because the soil was difficult to dig in. No foundations were necessary for the installation of the solar posts.

Manager Ben Gordesky, from DC Energy Innovations, said that "Community solar is a great way to go solar. The utility is required to divide up the benefits from the solar as the owners choose. In addition, the increased scale of a group project provides better



The Westford, VT, 17.5 kW Coyote Ridge Community Solar System was completed in October, 2013.

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economics (more benefit per dollar invested) and helps out everyone in the group!"

More info can be found at www.dcenenergyinnovations.com or (802) 372-9514.

The 17.5 kW project includes 66 Solarworld 265-watt photovoltaic panels, 66 Enphase micro-inverters and is mounted on a Schletter PV Max fixed racking system.

From October 1 to December 3, 2013, the system produced 2,710 kWh of energy and offset approximately 4,036 lbs of CO₂ during this time.

Expectations

- This community solar project is expected to produce roughly 20,400 kWh of clean renewable energy per year.
- The expected payback is approximately 10 years.
- The system is expected to reduce carbon emissions by 31,640 lbs. per year based on the EPA average of non-baseload electricity generation emissions factor, as above

Projections

- Projected system lifetime: 30 to 40 years.
- Projected lifetime output: 718,080 kWh
- Projected lifetime reduction in power cost: \$215,000

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TIME FOR CORPORATE CHANGE

By George Harvey

For big fossil fuel companies, the chickens are coming home to roost.

When people are unhappy with a company, one way for them to protest is to buy stock in the company and show up at the annual meeting, demanding to be heard and answered. Two organizations that have recently experienced this are the Bank of America and Comcast. Depending on the company and the rules, a group of protesters, each having a single share, can be very disruptive.

A group of organizations has taken this form of protest to a new level. Seventy organizations have come together to send letters to forty fossil fuel companies, demanding to be told what those companies were going to do about climate change and the effects it will have on their profits.

The thing that is new, and the thing that takes this to a previously unheard-of level, is that these are not environmental organizations, but rather funds, state agencies, and commercial investors. They are not holding a single share each; their combined assets are worth \$3 trillion. For clarity, perhaps we should see that in numerical form; it is \$3,000,000,000,000.

They are not appealing to the soft side of big business either. They are hitting its soft underbelly. They are demanding explanations of how fossil fuel

companies will survive in a world undergoing changes brought about by global warming resulting from use of fossil fuels, where governments want to discourage use of their products, where their infrastructure is being damaged by human-caused phenomena, where their investments are being devalued by declining market, and where their competition is growing from sustainable power sources that do not need any fuel at all.

Some of these forty companies will almost certainly answer as demanded. After all, the investment organizations making the demands are not merely stockholders, but major stockholders – the sorts that could buy and sell big producers or, more to the point, fire their boards of directors. To be acceptable, the answers will have to acknowledge the problems they are causing, even if they deny responsibility. They are going to have to go on the record as saying that global warming is real. Some of them will probably go further and say it is manmade.

The failure to respond, which some will doubtless attempt, will be expensive. If the organizations behind the letter disinvest, the prices of stock will go down appreciably, other investors will reassess fossil fuel companies, and those investors who fail to disinvest will lose money.

A new level of change may be on the way. ♪

VIRTUALIZE FOR A GREENER BUSINESS

By John Burton

Companies can reap cost-savings through a new generation of technologies that greatly reduce carbon footprints. The benefit of “virtualization” has been embraced in most large businesses but only 37% of small businesses take advantage of this technology today.

Virtualization, in computing, involves creating a virtual (rather than actual) software layer on the computer. This virtual process often takes place on the server but can also be used to create a virtual PC as well. Many key functions such as email or accounting can be combined onto fewer servers which will allow them to operate at a higher utilization rate.

So why should small to medium-sized businesses virtualize?

A company can buy fewer servers.

As a company grows it typically adds more servers to perform individual tasks on the network

Each server has a utilization rate of 6 to 12%. Combining these functions eliminates the need to buy other servers

Fewer servers mean that about five fewer hardware components are needed.

This can yield a 30 to 40% energy savings as well as significant cost savings

Wise power management can now detect an unused virtual machine and allow it to be ‘powered down’ to reduce even more resources

The result is less energy use

Desktop computers can also be virtualized which means they will remain always on without wasting energy on each

machine.

If your computer “sleeps” when it isn’t being used, not only is there energy savings but also the machine will last longer, and the company can invest in less expensive computers because they won’t need to be energy-intensive.

Virtualizing the desktops facilitates the distribution of new software and upgrades to all the company’s users from a central location.

“Cloud” service vendors are highly motivated to use energy efficiently and are expected to grow dramatically in the next several years.

These vendors use energy gains through virtualization and other power efficiencies to lower environmental impact without sacrificing reliability.

By moving to an energy-efficient Cloud vendor, all businesses can make a meaningful reduction in their carbon footprint.

The energy-hogging servers of the past are no longer necessary for any size organization to yield the required performance and capacity. Any small business can now migrate to more energy-efficient configurations incorporating virtualization technology and other sustainability practices. As the “green” movement continues to build steam, even the smallest of businesses are tapping technology to save money, boost energy efficiency and preserve the environment.

John Burton is President of NPI in South Burlington Vermont. NPI is a technology management company improving the performance of businesses with a triple bottom line of people, planet and profit. ♪

SAMSØ ISLAND IS 100% RENEWABLE

By George Harvey

Samsø is an island off the northeastern coast of the mainland part of Denmark. It is about 43 square miles and has a population of about 4000. It is well known for its strawberries, and people from elsewhere in Europe have berry-picking vacations there. It is also known for new potatoes that are considered a delicacy in Parisian restaurants and sometimes fetch prices upwards of \$100 per pound.

In 1997, Samsø won a contest by the Danish government, making it the focus of an effort to bring an island to 100% renewable power. This gave the islanders the benefit of some support from the central government, but did not provide all their financing. They did much of that part themselves.

Work began in earnest eight years ago. At the time, 100% of energy in Samsø

came from imported fossil fuels. Islanders were emitting 11 ton of carbon dioxide per capita each year, one of the highest rates in Europe. Money to pay for the fossil fuels was flowing out of the community as fast as money to buy strawberries and potatoes was coming in.

Since that time, 11 onshore and 10 offshore wind generators have been installed. Nine of the onshore turbines are owned by local farmers, with the others owned by co-ops. Offshore turbines provide power to offset fossil fuels imported for vehicles, though ultimately, vehicles should be switching to local fuel sources.

Nearly two-thirds of all buildings are now heated by three district heating systems, powered by locally grown straw. Other buildings get solar heat, biomass from straw or wood pellets, or use ground-source heat pumps.

Now, two years ahead of schedule,

Samsø is arguably 100% renewably powered, with energy exports exceeding imports and offsetting remaining fossil fuel usage by vehicles. In eight years, the island has switched from one of the most heavily dependent places in Europe, with one of the largest per capita carbon footprints, to one of the most independent, with carbon emissions among the smallest.

NIMBYism is not a problem unique to English-speaking lands. Early on, windpower was the object of opposition. Søren Hermansen, a local farmer who teaches environmental studies, made it a personal task to make sure everyone understood the nature of both the problems the world is facing and the solutions the islanders could implement.

Eventually Hermansen understood that NIMBYism can be overcome by engaging people. The benefits of being able to be part of cooperative ownership of the facilities, saving money on energy, were clear.



Main Street of Ballen, a village on the Danish island of Samsø.

In time, other benefits became clear, too. Permanent jobs, new businesses, and increased tourism all brought new income to the island. In 2007, the Samsø Energy Academy opened, providing renewable energy research, education, and training. The academy has exhibits and classes for people from other places. Now the islanders, who have become rather expert on renewable power, can share their knowledge with visitors. ♪

Wind is NOT The Problem

By George Harvey

Since our October issue appeared, the news has brought a few surprises. One of them was about Ian Dunlop, who had been a Shell executive for decades and chairman of the Australian Coal Association. He is running for the board of BHP Billiton, the world's largest mining company, as an outsider. It seems Mr. Dunlop had seen the hand writing on the wall, both for global warming and for the fossil fuels industry. He has jumped ship and become a climate activist. And he believes the BHP Billiton board needs a climate activist.

He has accused the fossil fuel industry of "stuffing up" effective action on climate change. It seems they are using every conceivable means to prevent action, because any effective change will decrease their profits. That being the case, it should be no surprise that every form of renewable power has its activist opponents, ultimately powered by the fossil fuel industry.

Perhaps one of the most pernicious elements of opposition to windpower is the pseudo-environmentalist view that preventing wind turbines from being installed will preserve hilltop habitats. It will not preserve them, because it cannot preserve them.

The Vermont Agency of Natural Resources has a series of papers on climate change. One of them, Climate Change and Vermont's Forests, speaks of our upland fir and spruce groves; our northern hardwood forests of maple, birch, and beech; our stands of hemlock; and our

numerous species of ash trees in these words, "These forests are expected to be nearly eliminated in Vermont..." (anr.state.vt.us/anr/climatechange/Pubs/VTCCAdapt-Forestry.pdf)

I am reminded of Michael Landon, star of Bonanza and Little House on the Prairie. In 1991, he told the press that he had been diagnosed with pancreatic cancer, and had been given less than a 1% chance of having it go into remission. He said he would beat it, however, because his fundamental health was good, a point he proved by doing a number of pushups. He did look to be in good health, but less than three months later he was dead.

The state of most of the forests in New England is much like that of Michael Landon in his terminal illness. They may look good, but we cannot save them from climate change. It takes a long time to heat up a planet, and even if we stopped pushing out carbon emissions today, changes will continue for another twenty years. But we are not stopping emissions. We are not even slowing down. We are only beginning to stop accelerating. And for the forests, it is almost certainly too late already.

Even if we act to do the best we can, the habitats will be radically altered. Nevertheless, we must do the best we can. If we



Searsburg, Wind Farm in Vermont. Pictured are 4 or the 11 550-kW turbines. The 6 MW farm produces enough electricity to supply 1600 average VT households.


stop emitting the green house gasses as soon as possible, we cannot keep the forests we have, but we can have different, beautiful forests. We may not prevent the loss of our fall colors, maple sugar, ski resorts, or even our apple orchards. But we can have lovely green mountains, and the fall colors can be restored with new species imported from places like North Carolina. Our children, and their children cannot have our New England, but they can have a New England they can cherish, and they may even live healthier lives than we do.

It is, of course, not just a matter of environmental habitats being used to oppose wind. Every environmental response is under attack. Science and economics, however, support very few points of opposition, and nearly none relating to windpower.

To stop climate change, we have to stop using fossil fuels. To stop using fossil fuels, we have to use the other resources we have. The problem is not windpower. It is climate change. Windpower is something we need to stop climate change. ♡

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Photo: the 48 Megawatt Groton Wind Project

FEDERAL

Federal Investment Tax Credit

The federal investment tax credit (ITC) for most technologies, including solar, wind, heat pumps, and fuel cells, is 30% of expenditures. For commercial geothermal generating systems, microturbines, and combined heat and power the ITC is 10% of expenditures.

USDA Rural Development Program

USDA Rural Development Program - Rural Energy for America (REAP)

Finance the purchase of renewable energy systems, and make energy improvements; energy audits. Funding is awarded on a competitive basis; grant funding cannot exceed 25% of eligible project costs and combined loan guarantees and grants cannot exceed 75% of eligible project costs.

Applicants include Feasibility studies/regular REAPs: agricultural producers and rural small businesses. Energy audits and renewable energy development assistance: local governments, tribes, land grant colleges, rural electric coops, public power entities. Grant must be used for Construction or improvements, purchase and installation of equipment, energy audits, permit fees, professional service fees, business plans, and/or feasibility studies. Find more at www.rurdev.usda.gov/NH-VTHome.html or call 802-828-6080 in VT or 603-223-6035 in NH

Biorefinery Assistance Program

As the call for increased production of homegrown, renewable forms of fuels has grown, so has the need to develop and produce them. USDA Rural Development offers opportunities to producers to development such fuels through the Biorefinery Assistance Program. The program provides loan guarantees for the development, construction, and retrofitting of commercial-scale biorefineries.

The Biorefinery Assistance Program was established to assist in the development of new and emerging technologies for the development of advanced biofuels and aims to accomplish the following:

- Increase the energy independence of the United States
 - Promote resource conservation, public health, and the environment
 - Diversify markets for agricultural and forestry products and agricultural waste materials
 - Create jobs and enhance economic development in rural America
- For More information go to www.rurdev.usda.gov/BCP_Biorefinery

REGIONAL

New England Grassroots Environmental Fund

- Modest grants are available for community-based environmental work in CT, MA, RI, NH, VT, ME
- Must be volunteer driven or have up to 2 full time paid staff or equiv.
 - have an annual budget up to \$100,000
 - "Seed" grants of \$250-\$1,000 and "Grow"

grants of \$1,000-\$3,500

- Go to www.grassrootsfund.org/grants/ or call 802-223-4622 for more info.

VERMONT

Clean Energy Development Fund

The The Small Scale RE Incentive Program, administered by Renewable Energy Resource Center (RERC), provides funds to help defray the costs of new solar thermal, photovoltaic, and micro-hydro systems

Solar Incentives – based on rated capacity of system

- <http://rerc-vt.org/incentives/index.htm>
- <http://www.dsireusa.org/incentives>
- residential (including leasing) = \$0.25/Watt up to 10 kW for PV; \$1.50/100Btu/Day up to 200kBTu for ShW.
- commercial/industrial = \$1.50/100Btu/day up to 1100kBTu/day for ShW
- special customer* = \$1.25/Watt up to 10kW. \$3.00/100 Btu/day up to 1500 kBTu/day for ShW. **Group net-metered projects are only eligible for residential customers with residential meters.
- PV and ShW Efficiency Adder - adder is calculated separately and added to standard incentive subject to customer caps (eligibility requirements apply, contact RERC)
- residential = \$0.15/Watt for PV; \$0.50/100Btu/day for ShW. Capped at a cumulative \$350, residential customers; \$450, commercial/industrial/special customer = \$0.15/W; \$0.50/100Btu/day up to a cumulative \$450 per customer

Micro-Hydro

- residential/commercial/industrial - \$1.75/3'gal/minute Capped at \$8750
- special = \$3.50/3' gal/minute Capped at \$17500 or 50% of installed cost

***special customer category limited to municipalities, non-profit housing authorities, public schools. All incentives are subject to availability and may change.*

Visit www.rerc-vt.org or call (877)888-7372

VT TAX CREDITS

Vermont offers an investment tax credit for installations of renewable energy equipment on business properties. The credit is equal to 24% of the "Vermont property portion" of the federal business energy tax credit from 2011 to 2016. For solar, small wind, and fuel cells this constitutes a 7.2% state-level credit for systems and for geothermal electric, microturbines, and combined heat and power systems, this constitutes a 2.4% state-level tax credit. Any unused tax credit may not be carried forward.

EFFICIENCY VERMONT

Lighting (must be ENERGY STAR)

- CFLs - select ENERGY STAR qualified spiral and specialty CFLs are just 99¢ at participating retailers
- LED's - bulbs with special pricing/ coupons at register while supplies last at participating* retailers

Home Efficiency Improvements

- improvements: air sealing, insulation and heating system upgrades - up to \$2,100 in incentives - using participating* contractors

Appliances (must be ENERGY STAR)

- Dehumidifiers - \$25 mail-in rebate

- Clothes Washers - \$40 rebate for CEE Tier 3 qualifying models, \$75 rebate for ENERGY STAR Most Efficient
- Refrigerators - \$40 rebate for CEE Tier 2 Refrigerators, \$75 for CEE Tier 3 & ENERGY STAR Most Efficient
- Working second refrigerators or freezers are potentially eligible to be picked up. \$50 incentive to retire old units.
- Clothes Dryer -rebate for replace electric with natural gas (contact EV*)

Heating/Cooling

- heating & hot water systems - see EV*
- energy efficient central AC and furnace fan motor - \$100 mail-in rebate
- central wood pellet boilers (excluding outside wood systems) - \$1,000 (See announcement on page 25)

Residential New Construction

- enroll in Residential New Construction Service - up to \$1,500 in incentives and free home energy rating and expert technical assistance throughout construction and eligible for ENERGY STAR label
- Washington Electric Coop and Vermont Gas Systems customers may also receive additional incentives (contact EV*)

Other Opportunities To Save

- Advanced Power Strips - special pricing/ coupons at register at participating retailers*
- Pool Pump (2-speed/variable speed) - \$200 mail-in rebate
- Meter Loan - borrow "Watts Up" meter to measure the electric consumption of your appliances

**all rebates/incentives subject to availability, limits and may change - for complete incentives and requirements, and for participating retailers/contractors, visit efficiencyvermont.com or call 888-921-5990*

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Public Utilities Commission

Commercial Solar Rebate Program

Program open to non-profits, businesses, public entities and other non-residential entities

- Rebates for solar electric/thermal projects 100kW (or thermal equivalent) or less
- Solar PV = \$0.80/Watt D/C up to \$50,000
- Solar thermal = \$0.07(or\$0.12 for systems of 15 collectors or fewer) per thousand- Btu per year, up to \$50,000

Contact jack.ruderman@puc.nh.gov

Residential Solar PV Rebate Program

- \$0.75/watt capped at \$3,750 per system, whichever is less. Systems must be under10kW. Subject to funding availability.

Contact jon.osgood@puc.nh.gov

Residential Solar Water Heating Rebate Program

- \$1500 - \$1900 per system based on annual system output
- Contact barbara.bernstein@puc.nh.gov

Wood Pellet Boiler or Furnace

- 30% of installed system up to \$6k

- Must meet thermal efficiency and particulate emissions standards
- Contact barbara.bernstein@puc.nh.gov www.puc.nh.gov - Sustainable Energy or tel. 603-271-2431 for more information and current program status

Local Incentives

Some towns provide property tax exemptions for renewables - visit www.bit.ly/NHtownRenewablesTaxBreaks

- These are offered on a town-by-town basis.
- The state also has passed PACE (property-assessed clean energy) enabling legislation which will allow towns to use the PACE mechanism to finance clean energy projects through property taxes. Visit <http://www.nh.gov/oep/programs/energy/pace/index.htm> for more information.

Renewable Energy Incentives Offered Through the NH Electric Co-Op Commercial Renewable Energy

- is 25% of the project cost up to \$20,000.

Residential Solar PV

- is 20% of the project cost up to \$2,500.

Residential Solar Hot Water

- is 20% of the project cost up to \$1,500.

Heat Pump Water Heaters

- is 50% of the project cost up to \$1,000.

Heat Pump Conversion

- is 35% of the project cost up to \$10,000 for Geothermal Heat Pumps.
- is \$450-\$900 per system based on SEER rating for Ductless Mini-Split Heat Pumps.
- is 35% of the project cost up to \$3,500 based on SEER rating for High Efficiency & Hybrid Central Heat Pumps.
- is 35% of the project cost up to \$25,000 based on SEER ratings for Commercial ground or air source heat pumps and ERV's.

PAREI

To explore the possibility of a solar installation. Plymouth Area Renewable Energy Initiative. www.plymouthenergy.org

www.nhsaves.com NH Home Performance with ENERGY STAR

Sponsored by all NH electric and natural gas utilities in partnership by the U.S. Dept. of Energy. Fuel-blind eligibility using the Home Heating Index (BTUs of heating fuel / conditioned square feet / heating degree days). Must provide at least 12 months of heating fuel history. Once qualified, eligible homes get a \$450 value comprehensive energy audit for \$100 (rebated if improvements installed), and 50% instant rebate for eligible weatherization improvements up to a \$4,000. Visit www.nhsaves.com/residential/retrofit.html for more information and an online Home Heating Index calculator

NH ENERGY STAR Homes

Incentives for builders of new homes who meet ENERGY STAR guidelines. Incentives include HERS rating fee paid by the utility, rebates for ENERGY STAR lighting, appliances and heating systems, and \$800 - \$4,000 additional incentive depending on the HERS score.

Visit www.nhsaves.com/residential/homes.html for more details.

NH ENERGY STAR Appliances & Lighting

Mail-in rebates for ENERGY STAR-rated clothes washers (\$30), room air conditioners (\$20), room air purifiers (\$15) and smart strips (\$10).

Visit www.nhsaves.com/residential/es_appliance.html for more information and rebate forms.

Instant rebate coupons ranging from \$1 to \$7 for ENERGY STAR-rated CFL and LED light bulbs purchased through qualifying NH retailers.

Visit www.nhsaves.com/residential/es_lighting.html for more information.

nhsaves Lighting and Efficiency Catalog

Extensive catalog of efficient lighting products, from stylish lamps to hard to find specialty bulbs. Catalog includes other efficiency items such as smart strips, power monitors, and water-conserving devices

Offered at discounted pricing for NH electric utility customers, and fulfilled by EFL.

Visit catalog.nhsaves.com/ for an online version of the catalog.

Other NH Electric Utility Programs

See also individual utilities for additional programs and variations. NH electric utilities may offer low or no interest on-bill financing for energy efficiency projects.

Visit www.nhsaves.com/resource/ for individual utility contact information.

Business Programs

Includes programs for: small and large business, new equipment and construction, seminars, lighting incentives and catalog, and low and no interest financing programs.

Visit www.nhsaves.com/ for information about NH business incentives for electricity efficiency.

NH Weatherization Assistance Income-Eligible Programs

Home Energy Assistance and NH community action Weatherization Assistance Program. Financial assistance paying fuel bills, and free weatherization improvements for qualified applicants. Funding from U.S. Dept. of Energy, NH utilities and Greenhouse Gas Emissions Reduction Fund (RGGI).

Visit www.nh.gov/oep/programs/weatherization/index.htm for application criteria, FAQs and local program contacts

MASSACHUSETTS

Commonwealth Solar Hot Water (SHW) Programs

Applicants must be served by National Grid, NSTAR, Unitil (Fitchburg Gas and Electric), WMECO or a participating Municipal Light Plant community.

- Residential Rebate: \$25/per collector X the SRCC thermal performance rating of the collectors (pls refer to kBtu/panel/day for Category C, Mildly Cloudy climates)
- Metrics for typical SHW system for 2-4 people, 2-panel roof-mounted plus 80 gal solar tank: materials/installation costs = \$10,000, MA CEC residential rebate = \$2400 including • Adder for moderate home value or for moderate income. MA State Tax Credit (use only once) = \$1000, Federal Tax Credit (30%

system cost) = \$3000, Net Cost = \$3600

Visit www.masscec.com/index.cfm/page/Commonwealth-Solar-Hot-Water/cdid/1176/pid/11159#shwresources

Commercial Solar Hot Water rebate program info

<http://www.masscec.com/solicitations/commonwealth-solar-hot-water-commercial-scale>

MassSave Heat Loan SHW

Through this loan program, customers may borrow at 0% interest the costs of a Solar Domestic Hot Water and/or Thermal Heating system minus the MA CEC rebate. Apply through receiving the MassSave Energy Audit.

Efficiency

After conducting a free residential Energy Audit, residential customers are eligible for up to \$25,000, commercial loan up to \$100k at 0% interest heat loan with terms up to 7 years to cover the following energy efficiency improvements: attic-wall-basement insulation, high efficiency heating systems, high efficiency domestic hot water systems, solar hot water systems, 7-day digital programmable thermostats, Energy Star replacement windows

Available only to utility customers of Western Mass Electric, National Grid, Berkshire Gas, Nstar, Unitil and Cape Light Compact Visit www.masssave.com/residential/heating-and-cooling/offers/heat-loan-program Please call 866-527-7283 to schedule a free home energy assessment.

Commonwealth Solar PV Programs

www.masscec.com

Commonwealth Solar II provides rebates for homeowners and businesses in Massachusetts who install solar photovoltaics (PV). Rebates are granted through a non-competitive application process for the installation of photovoltaic (PV) projects by professional, licensed contractors at residential, commercial, industrial, institutional and public facilities. In addition to the base incentive, further incentives ("adders") are available for installations using components manufactured in Massachusetts, for individuals with moderate income or home values, and for those who are rebuilding in the wake of a natural disaster.

For all systems, rebates are calculated by multiplying the per watt incentive (base incentive plus adders) times the nameplate capacity of the system, up to 5 kilowatts (kW); projects are eligible for rebates only if their total capacity is under 15kW. Further eligibility requirements apply, and potential rebate recipients should read the full program documentation.

<http://www.masscec.com/solicitations/commonwealth-solar-ii-block-16>

Dept of Energy Resources

- Solar renewable-energy credits (SRECs) associated with system generation belong to the system owner and may be sold via the Department of Energy Resources (DOER) SREC program. Note: appropriate, approved tracking must be utilized in order to qualify to sell SRECs.
- MA State Income tax credit for residential solar hot water or pv systems are eligible for a one time 15% off system cost, capped at \$1000 max tax credit.
- No sales tax on solar hw or pv systems.
- There is no increase in property tax assessment for residential hw or pv systems for 20 yrs.

BURLINGTON ELECTRIC DEPARTMENT, FIRST WIND REACH AGREEMENT TO SELL POWER GENERATED BY HANCOCK WIND PROJECT

Boston, MA and Montpelier, VT – First Wind, an independent U.S.-based renewable energy company, announced on December 6 that the company has reached an agreement with Burlington Electric Department (BED) to sell the utility power generated from the planned Hancock Wind project near Ellsworth, Maine.

First Wind will sell 25% of the power and renewable energy certificates (RECs) generated at the 54 megawatt (MW) wind farm for the next 10 years under a fixed-price agreement to the Vermont utility.

Barbara Grimes, general manager of BED, expressed her enthusiasm for the project. "BED has a goal of bringing more renewable power to its customers, and this contract will help us achieve that goal. Stably priced, clean, green and locally generated power is the way to keep our economy strong and our environment clean," she said.

"We're happy to help BED meet its renewable energy goals," said Paul Gaynor, CEO of First Wind. "This project will help provide clean, renewable energy to Burlington ratepayers at a highly competitive cost, and the Hancock Wind project will deliver significant economic benefits throughout Down East Maine."

BED is seeking to source 100% of its supply needs from renewable energy. The addition of the energy from the Hancock Wind project will bring the utility to 92%.

When built, the Hancock Wind project will feature 18 turbines with a capacity of 3 MW each, and it will be situated near the operating 34 MW Bull Hill Wind project in Hancock County, ME, which began operations in November 2012. The energy is being sold to BED at a cost-competitive price that will help to stabilize the utility's rates over the 10 years of the contract, in addition to the renewable energy credits.

First Wind currently operates five wind projects in Maine and one in Sheffield, VT. Combined, the six projects generate enough electricity to power about 100,000 homes.

About First Wind. First Wind develops, finances, builds and operates utility-scale renewable energy projects throughout the United States. Based in Boston, First Wind currently operates wind power facilities in the northeast, the west and Hawaii, with combined capacity of more than 1,000 MW – enough to power about 300,000 U.S. homes. For more information on First Wind, please visit www.firstwind.com or follow us on Twitter @FirstWind.

About Burlington Electric Department. BED is the municipal utility of Burlington, VT, and provides all the electricity within the borders of Burlington and at Burlington International Airport. Sixty-five percent of BED's power comes from renewable energy. BED has been able to meet the needs caused by the growth within the city since 1989 with energy efficiency. Please visit at www.burlingtonelectric.com and follow us on Twitter @burlingtonelec.

Power Consumption of Typical Household Appliances

One way to compare the cost of running different appliances is to look at their power consumption, which is measure of how much power they use in Watts. Typical values for the wattage of some devices in your home are listed below. *Note that the length of time one uses an appliance needs to be added to the equation in order to get a complete idea of one's energy consumption. Conservation is the key to reducing power consumption.*

Appliance	Minimum	Maximum	Appliance	Minimum	Maximum
Ceiling Fan	10W	50W	100W light bulb	100W	100W
Circular Saw (7 1/4"-8 1/2")	900W	1400W	CFL Lightbulb	13W	15W
Clock radio	1W	2W	LED Lightbulb	6W	8W
Clothes dryer	4000W	4000W	Fluorescent Tube (4 ft)	48W	48W
Computer (Laptop)	20W	50W	LED Tube (4 ft)	20 W	20W
Computer (Desktop)	50W	150W	Microwave	600W	1700W
Computer (CPU, monitor, printers) up to		1550W	Oven (electric)	2150W	2150W
Dishwasher	1200W	1500W	Oven (gas, glowbars)	200W	300W
Drill (1/4"-8")	250W	1000W	Sander (3" belt)	1000W	1000W
Electric Blanket	200W	200W	Sander (9" disc)	1200W	1200W
Electric Hotplate	1200W	1200W	Satellite dish/Internet	30W	65W
Electric Mower	1500W	1500W	Sewing Machine	100W	100W
Electric Shaver	15W	20W	Sink Disposal	450W	450W
Refrigerator (Energy Star)	370-540 kWh/yr.		Stereo	10W	100W
Freezer	350W	450W	Water Pump(Submersible)	400W	400W
Furnace Blower	300W	1000W	Table Fan	10W	25W
Hair Blowdryer	1000W	1000W	Toaster	800W	1500W
Home A/C (NA)	1500W	2-5000W	TV (30" flatscreen)	67W	105W
Iron	1000W	1000W	Vacuum Cleaner	200W	700W
Lawnmower	1000W	1400W	Waffle Iron	1200W	1200W
Incandenscent bulb	60W	60W	Washing Machine	500W	500W

Please be mindful that this issue of Green Energy Times covers both the ending of 2013 and the start of 2014. With the new year, some of these incentives will change.

Solar Powered Heat Pumps = *Peace of Mind*

By Frederick Greenhalgh

As they approached retirement, mechanical and electrical engineer Mike Tabone and his wife Louise spent some time thinking about what they wanted their life to look like. With tumult in the financial markets, investments in more traditional avenues seemed a risky proposition, while the reality of rising energy costs seemed certain.

"I'm old-school," Mike says, "When I was a young man, I was taught self-sufficiency. That means being able to take care of yourself and your family from things like



low as -15°F.

The same technology used to heat local schools would work just as well in his home. He calculated that it would cost less than half as much as oil to heat his home using electricity with these high-efficiency units, so, he made the switch. Mike settled



The Tabone solar-powered home in NH use heat pumps to keep warm all winter and cool in the summer.

skyrocketing costs of oil."

His hunt for a better way to heat his home started with an article about local schools converting to electric heat pumps. He was impressed with the fact that modern mini-split heat pumps would produce heat in outdoor temperatures as

on three Fujitsu heat pump units to provide for all of the space heating and cooling needs of his home.

But a switch to electric heating alone didn't meet Mike's aims for true independence, and he realized that since he was now using electricity for heating and

- 1 Outdoor unit extracts heat from ambient air and moves it inside
- 2 Indoor unit releases warm or cool air into home depending on the season
- 3 Connect a solar electric system to the Air Source Heat Pump unit and use the sun to power your heating and cooling!



The basement equipment

cooling, he could generate that electricity using solar power. "I bumped into a customer of [local solar installer – ed.] ReVision Energy, and got to talking about electric cars and solar energy. I was invited to take a tour of their home and was excited by what I saw."

Mike and Louise discovered their south-facing roof had enough room to install a 12kw solar electric array, consisting of 47 Canadian Solar monocrystalline solar panels connected to Enphase microinverters. Between April 4 and December 4, 2013, the system had produced over 9,550 kWh of electricity – close to 100% of what the Tabones will need to heat their home this winter.

"We haven't burned a drop of oil since the day we installed the solar," Mike says, "It was a cold November and we had the heat pumps keeping our house comfortable even at 8° outside. It looks like we'll make it all the way to January without having spent a nickel on energy."

To track system production, Mike installed an eMonitor device which tracks his home's electric usage in real-time, which he can compare side-by-side to his solar production. So far, the solar production estimates appear on track, and Mike estimates his family has saved \$3,900 on energy costs in just 8 months.

"There is an incredible feeling of pride and peace of mind in having the solar electric array on our roof," he says, "My wife

How Heat Pumps Work

Mini split heat pumps are electric heaters that uses refrigerant to extract heat from the outside air, even during cold temperatures. Heat pumps rely on the refrigeration cycle in the same way as your refrigerator or freezer does, extracting heat from the air even at very cold ambient temperatures. ReVision Energy utilizes an advanced refrigerant called R410A that boils at a very low temperature (as low as -60 deg F) at ambient pressure, and thus can absorb heat energy from even very cold outside air. The heat pump compressor then pressurizes and pumps the refrigerant inside where it passes through a condenser and gives up its heat to the indoors. Because the heat pump is simply moving heat around, rather than creating it, the unit is 2-3 times more efficient than traditional 'resistive' electric heat.

As an additional benefit, the refrigerant can also move through the cycle in the opposite direction – absorbing heat inside your home and releasing it to the outdoors, making the heat pump an exceptionally efficient air conditioner as well as a heater. Because of the advanced controls and refrigerant, mini-split heat pumps typically use roughly half as much electricity in cooling mode when compared to a conventional window air conditioner.

There are a great variety of heat pumps in the market; the most popular ones currently in the Northeast are 'ductless mini-split' types, meaning that there is no ductwork in the house. The system consists of just an indoor blower unit and outdoor cooling unit connected by a small diameter copper refrigerant line set. The highest performing heat pumps are usually installed as 1:1 models (1 indoor per 1 outdoor unit) but 2:1 'multi-split' units are available as well for multi-room and multi-zone applications.



Above: Two mini-split heat pumps outside the Tabone residence. Right: The Heat Pump interior unit

said to me, 'I thought you were crazy at first, but now I realize what a great thing you've done. No matter what happens, we're free from the burden of energy bills for the rest of our lives. It's a hell of a feeling.'

Frederick Greenhalgh is a manager of Revision Energy in Exeter, New Hampshire. 🐦

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VECS - BUILT UPON IMAGINATIONS

By George Harvey

Here is a question for you. What started with a design for wood-burning boiler, is a high-tech industrial grade controller, is in every way a Vermont product, and can help with cleaning equipment in a dairy barn? I bet you could not guess.

Vermont Energy Control Systems (VECS) was built upon the imaginations of two fascinating Vermonters, Ralph Shepard

for domestic use, a hot tub, thermal storage in a large tank, and more.

When Ralph Shepard saw what Bill was doing, he was quickly motivated to participate. Ralph added management and promotional skills to Ralph's design and manufacturing abilities. And so VECS came into being, and with it, a remarkable computer called VESTA.

VESTA is not the sort of computer an

be simply to find out what is going on, so a system to control and maintain it can be designed.

VESTA can be programmed to control many kinds of equipment from heaters or coolers to communications devices, motors, and alarms. In fact, VESTA can be used on all sorts of stationary equipment.

An example of the system is Bill Kuhns' household energy design, which was mentioned earlier. Perhaps one day soon it will be so pervasive used it will be taken for granted. But until then, it is the sort of thing an energy-conscious homebody might dream of.

Another example of a use for the same VESTA computer is to control a utility system combining gasification, electric generation, and using residual heat to heat one or more buildings. A gasification system alone requires careful control, balancing temperature, air flow, and gas content, to keep it free of particulates and other pollutants, while delivering gas

with optimal chemical properties to the combustion unit of the generator. The

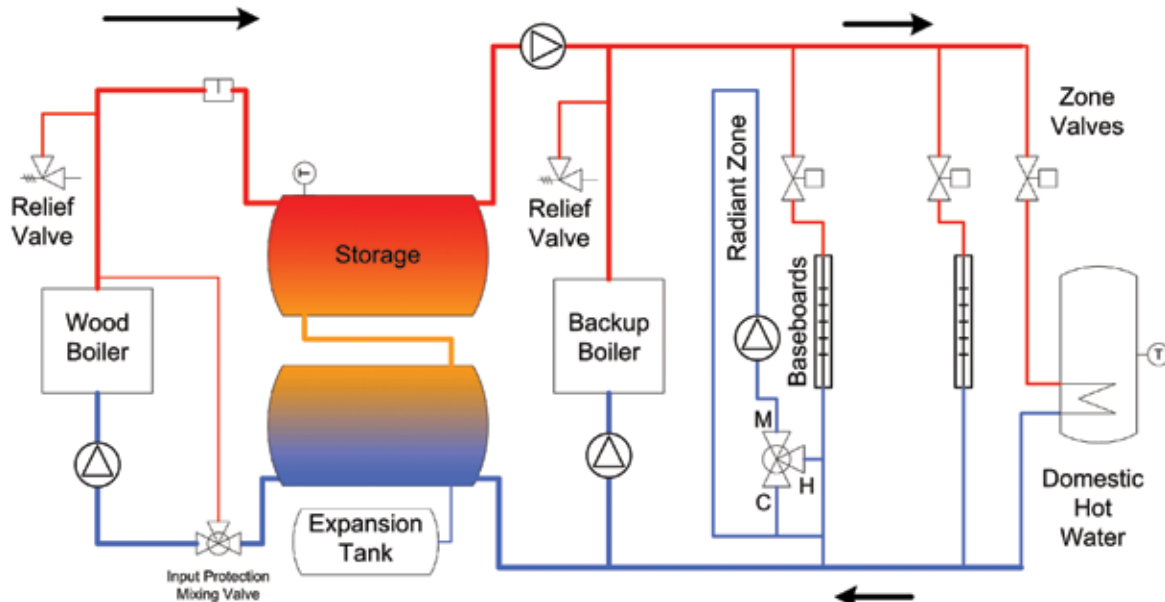
generator set has to be managed for optimal performance, including both quality of power generated and emissions. The residual heat has to be distributed to the points in the system where it is best put, with consideration given to other possible heaters that might supply heat.

The most fascinating example system is, perhaps, one that VECS is working on with the Vermont Technical College, managing energy in a dairy barn. The VECS-VTC system is in its beginning stages of set-up. Data is being analyzed to see where controls can be put for best management. Then, the management operations will be integrated, and the whole put into use.

It is easy to imagine a system that operates refrigerating equipment to keep milk cool, and uses the heat it produces for a house or office. The VECS-VTC operation will go way beyond that, however. For example, it will extract the cows' body heat that is residual in the milk, cooling the milk as it does, and use the heat to sterilize dairy equipment. That is just one example; all the heat, cooling, and refrigeration demands of the barn are monitored and managed.

When asked what he most wants to tell people, Ralph said, "I want people to know we have a company in Vermont that developed a product to manage integration of alternative and reusable energy, from diverse sources, by tracking data and fine-tuning operations, based on their performance histories."

The VECS website is www.VECS.org. More information can be found at www.nofossil.org.



Parallel Wood/Oil Zone Valve System With Pressurized Storage

and Bill Kuhns. Both have wide-ranging abilities. Ralph Shepard's background includes blacksmithing and flying jet aircraft. Bill Kuhns has spent time with computer design, woodworking, and architecture. The eclectic set of abilities almost says, "Made in Vermont."

VECS started with a home project of Bill's, to control a wood-burning boiler. Bill quickly realized that controlling the boiler required input from the house, telling it what temperatures were and what temperatures were desired. This, in turn, required integrating the boiler with other equipment that had effects on the house's heat, a list of systems that grew to include backup heat, solar panels, water heating

ordinary person would want to use at home to manage email and pay bills. It is, however, the sort of thing an ordinary person would want to use at home to manage the home itself. Its equipment-controlling abilities are impressive, its interface is familiar, and its price is affordable, at less than \$1000.

VESTA has inputs and outputs connecting to the real world. It can acquire data on temperature, humidity, or just about anything else that can be measured, and it can take in data from a large number of different sensors simultaneously.

Once gathered, the data can be analyzed to determine what is to be done with it. The initial use of VESTA may, in fact,

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What do PV, SHW, Building Efficiency and Beer Have in Common?

The Woodstock Inn Station & Brewery



The Woodstock Inn, Station & Brewery at 135 Main St., No. Woodstock, NH, has achieved a level of energy efficiency that sets the standard for all businesses to follow. The resulting energy savings: \$28,000.

By N. R. Mallory

This \$2.3 million dollar, 13,000 square foot energy efficiency achievement is an impressive business effort! Has owner, Scott Rice left any stones unturned? The extreme collaboration and actual magnitude of this project at the Woodstock Inn Station & Brewery is going to be a tough act for any business to follow!

Already the largest employer in Woodstock, New Hampshire, with 100 employees in season, the two-year project has allowed owner Scott Rice to open a new function room and move his successful brewing operation in-house while creating 12 to 15 new jobs. The achievements will result in annual energy savings of \$28,000.

The New Hampshire Electric Cooperative (NHEC) "has been an indispensable partner in planning for our electric needs," Rice said. "They spent a lot of time and effort working with me on my renewable and energy saving options for the new construction, and also on improving our current facility for electricity and fossil fuel usage."

With care to preserve the appearance of the town's Main Street, NHEC relocated a three-phase electric service entrance to increase reliability. That enabled a

series of energy efficiency improvements, including an ozone cleaning system in the Inn's laundry, energy-efficient lighting, four air source heat pumps for heating and cooling, and a solar photovoltaic (PV) system.

"Like the extensive construction plans," Rice said, "planning the energy infrastructure improvements was well worth the time." The folks at the NHEC devoted a lot of time going through all sorts of options until we finally came up with a plan that



The Woodstock Inn, Station & Brewery's annual projected energy savings from the hybrid heat pumps is \$12,635. Seely Heating, Plumbing & A.C., from Meredith, NH, installed the Heat Pump system.

worked for my business."

ACHIEVEMENTS:

1. Building Envelope. Alba Architects, from Woodstock, NH were hired for the building envelope. This company is known for maximizing performance and exceeding efficiency codes, with consideration for a client's budget and return on investment. With the Woodstock Inn Station & Brewery, the thermal resistance values (r-values) exceeded code by 33% for below-grade walls, by 10% for above-grade walls, and by 22% for roofs. The thermal package included a continuous insulation layer for the entire building envelope. Though recently retired, The Lawton Company, Inc. of Littleton, NH was the contractor.

2. Heating & cooling. Seely Plumbing, Heating & AC, from Meredith, NH, took charge of the heating and cooling. The main systems are hybrids with three EXTREME Sub-Zero Inverter Heat Pumps at 60,000 BTU each, coupled with multi-stage back up furnaces at 120,000 BTU each. Mike Hamlin, an energy specialist for Seely explains, "We don't necessarily need that much heat, but we needed the CFM capacity for the Heat Pumps. It would be a rare event for them to run at full capacity. The heat pumps should do up to 90% of the heating. Hybrids are a benefit in power outages, when a small stand-by generator can run the furnace with little effort."

Two Mitsubishi H2i Extreme Sub-Zero heat pumps at 36,000 BTU capacity each, are expected to cover 90% or more of the heating required in the bar area.

The brewery has a Heat Recovery Ventilator (HRV) for the fermentation room. Another energy saving device is the stainless steel heat exchanger where wort from the brew kettle passes by in-coming fresh water for the mash tun, pre-cooling the wort on its way to the fermentation tanks.

Hamlin commented on the financial means that the owner of the Inn was able to use and that made this project become a reality, saying, "Scott is very smart. I'm hoping that some of his amazing 'fortune finding' will rub off on me."

3. Solar Photovoltaics (PV). Frase Electric & Solar, from Sandwich, NH was chosen to install an 18 kW photo-

voltic (PV) system on the new addition to the main building. The PV system was installed on the roof above the function room, prep kitchen, upper bar and the brewery. Fifty-four solar panels make up Lincoln/Woodstock's first solar supported business! The estimated production is in excess of 20,000 kWh annually. The 30-Barrel solar powered brewery is now the largest solar array north of Concord, NH.

4. Electric Vehicle Charging Station.



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The Charging Station was installed by New Hampshire Electric Co-op, as part of a new pilot program

NHEC put together a small pilot program to research potential for an electric vehicle charging stations in NH. The pilot program engaged NHEC commercial members, spread throughout their service territory, who were willing to spend money on the installation of a Level 2 electric vehicle charger. It will gather data until the end of 2014, so that NHEC can determine how to help members with this new technology.

5. Solar Thermal. ReVision Energy LLC of Exeter, NH is currently installing a solar thermal system to supply hot water for

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ARE LOW VOC COATINGS REALLY ALL THAT GREEN?

Staff article

Sutherland Welles Ltd®, located in the hamlet of North Hyde Park, VT, produces a wide range of Polymerized Tung Oil finishes for a wide variety of applications. Talking to Mary Goderwis, CEO of Sutherland Welles, we learned some very interesting points about volatile organic compounds (VOCs), and thought our readers might want to know about her insights, as they considered choices for finishes in their homes.

VOCs are any carbon compounds that evaporate at room temperature. There are many kinds, and they are not equally harmful. The ones of concern for medicine and the environment are those that are poisonous, and they are regulated by such agencies as the EPA. They include gasoline, home heating oil, fumes off-gassed from plastics, and many architectural coatings like paints and varnishes.

Like all regulated VOCs, those used in coatings are viewed with grave suspicion by many environmentally conscious people. We should consider this point carefully because they are different from one another and

spilled. Goderwis feels that for companies like hers and for professionals who use these products in their everyday work life, that health risk is unacceptable. And in truth, the performance of coatings using this solvent has also been compromised.

With a focus on producing products from a resource like sustainably grown



Photos courtesy of Sutherland Welles Ltd



tung oil, Goderwis could not in good conscience adopt the more toxic solvent, even if it meant lowering the VOCs or even being able to make a zero-VOC product. She is convinced the potential damage of

the solvent is simply not worth the risk. The folks at Sutherland Welles developed a proprietary solvent made from waste peels of oranges and other citrus fruit produced by the juice industry. Using it, Sutherland Welles can provide products with a range of 15 to 48 years of proven performance in quart quantities, selling it at a special pricing option to offset the higher quart cost. Botanical Polymerized Tung Oil was created long before before the recent trend for "Green" products, and has served them and their customers well.

"Time has a way of revealing the flaws in some approaches to the 'green' industry," Goderwis explains. She points out that when a product with no VOCs needs to be replaced frequently, it may ultimately be less kind to the environment than a longer-lasting one with low levels of rather non-destructive VOCs that can be maintained instead of being replaced. Most finishes need to be sanded when they are replaced, putting organic dust into the environment, but Polymerized Tung Oil only needs to be re-oiled, without sanding every five to eight years.

When it comes to choosing a finish for need to be treated differently. Clearly, for example, formaldehyde is not the same as ethanol. We might argue that when the government established standards, VOCs were considered together in ways that were over-hasty; those for coatings were considered together with those from such heavy polluters as vehicles and power plants. In some ways, the result was not what we might have hoped for. As Goderwis reports, "It was simple. The Architectural Coating industry is actually very small with a limited number of players. We were not as well represented by lobbyists in Washington as other industries." Regulations were introduced based on a "feel-good approach," without much science to back them. She explains, "You know when a company as big as Sherwin-Williams tries to reverse these restrictions and fails, small businesses are doomed."

Very few coatings could meet the new standards in packaging of a gallon or more. Water is one, but, as Goderwis explains, tung oil can't be put into a water-based formulation. There is only one other solvent available to oil finish manufacturers that allows them to prepare finishes that meet the lower VOC standards in their formulas. Unfortunately, that solvent is very toxic to humans and aquatic life if

When it comes to choosing a finish for

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GREEN BUILDERS IN OUR MIDST

FEATURING: R.H. IRVING HOMEBUILDERS

By N.R. Mallery

Starting with this issue of Green Energy Times, we will feature green and energy-efficient builders from around the northeast.

We will focus on trusted builders that can help you achieve your goals for energy efficiency and that understand why it is so important to build with the utmost efficiency in mind -- that sustainable building starts with an efficient building envelope for both new construction and existing buildings.

Wikipedia describes Green building as "a structure that is using a process that is environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and demolition. The Green Building practice expands and complements the classical building design concerns of economy, utility, durability, and comfort."

One objective common to all green

This is done by efficient use of resources, especially energy and water, and by reducing waste and emissions to avoid environmental degradation. The comfort of the human occupants is always an issue, and in a business environment, productivity should be considered.

Since buildings use over 40% of energy consumed in this country, homebuilders have a unique opportunity to contribute to reducing our fuel usage by utilizing proven techniques to make houses more energy-efficient. By doing so, the house becomes more comfortable and easier and more affordable to maintain. Every efficiency improvement implemented today reduces the amount of energy needed tomorrow.

The goal: ultra-low-energy homes.

R.H. Irving Homebuilders' mission is to build Net Zero Ready, comfortable, affordable homes that are enjoyable to live in. Located in Salisbury, NH, Bob Irving has over forty years of evolving experience that started with super-

insulated timber frame homes, most of which were enclosed with structural insulated panels (SIP's), and evolved into high performance homes utilizing standard "stick" as well as modular construction.

Today, with the rapid increase in financial and environmental costs of fossil fuels, and resultant climate

change from fuels' use, the need for building practices that place energy conservation in the forefront is back. "People are



"Homebuilders have both the opportunity and the obligation to do something about global warming and the energy crisis. We can build fossil fuel-free homes that use far less energy, that contribute less carbon to the atmosphere and that will be more healthful to live in. And, since houses can last 100-200 years or longer, these will be enduring contributions to the world." - Bob Irving, owner of RH Irving Homebuilders

once again asking for truly energy-efficient homes," says Irving, whose expertise in this area is once again in high demand. Irving has studied passive house design and construction as well as Net-Zero building and has dedicated his business exclusively to these levels of high performance building. He also specializes in upgrading existing homes to high performance levels through "deep energy retrofits" which involve thorough air sealing and extensive insulation upgrades. DERs typically upgrade the exterior of the home, so the interior remains unchanged and the process is hassle-free for those living there.

R.H. Irving Homebuilders, having built dozens of passive solar and energy efficient homes in a wide variety of designs all over New Hampshire and around New England, has extensive knowledge of high performance building practices,

including super insulation, triple-glazed windows, airtight construction, heat recovery ventilation systems, fossil fuel-free heating and cooling as well as designs that utilize natural daylight and passive solar heat. Most of all, the high performance building practices "fulfill an obligation we builders all have to do something about global warming and the energy crisis," states Bob Irving.

In the coming weeks, RH Irving Co., Inc. will be offering several new Net Zero home designs, available in modular or site built versions. These designs by one of the region's premier high performance architectural firms can be customized to meet the client's needs, and complete architectural custom design is also available.

Learn more about RH Irving Homebuilders at rhirvinghomebuilders.com. (603) 648-2635, or Bob@rhirvinghomebuilders.com.



buildings is to eliminate negative impacts of the building and its use on both human health and the environment.

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Cyan Magenta Yellow Black

BEYOND EFFICIENCY

FROM PASSIVE HOUSE TO THE LIVING BUILDING CHALLENGE

By Marc Companion

Our homes and buildings are complex structures that have a significant impact on the natural world, our communities and certainly our pocketbooks. A lot of excellent work is being done to improve building efficiency and to create green buildings. What's the difference between the two?

By way of example, let's take a look at two building performance standards that excel at transforming the way we design our buildings: Passive House and the Living Building Challenge.

Passive House is a voluntary standard that sets the bar for high performance thermal energy efficiency and comfort in buildings. The concept originated in Germany and Sweden in the late 1980s as a way to develop improved building technologies and an integrated design process. Passive House buildings are ultra-low energy structures that require very little energy for space heating and cooling. Think of thermal efficiencies so great that, for example, you might be able to heat your home with only a few candles or just the body heat of your family.

A key to Passive House-certified buildings is that they are super-insulated,

super-tight and well ventilated, thereby enabling thermal energy to be managed in a very refined way.

Consider space heating in the winter. The walls, foundation and other parts of the building envelope are so thermally efficient that very little heat escapes to the outside. The heat you generate indoors stays indoors. This allows designers to take advantage of the heat sources already within the building, such as waste heat from the operation of major appliances and lighting, and the recovery of heat from a warm shower. Occupants - both people and pets - also contribute toward energy production through the body heat we all emit continuously.

The result is a building with very small heating and cooling systems, which can dramatically reduce the structure's carbon and ecological footprint. Passive House buildings are quite comfortable, too, because the indoor temperature varies very little over time.

Moving beyond energy efficiency, we begin to think about the other systems that are part of our buildings. How does the structure affect its surroundings? What



This model of a house boat embodies a variety of green building principles, one of which is energy efficiency. Passive solar design and low-e glazing help improve thermal efficiency, while photovoltaics produce renewable energy, and Energy Star equipment increases electrical efficiency. Beyond efficiency, the boat also has a green roof for food production and a cistern to capture rainwater. Constructed wetlands on-board use local species to treat wastewater generated by the boat, and also serve an ecological restoration function. Nutrient-rich lake water containing unwanted algae blooms is pumped through the wetlands, which digest excess nutrients to improve lake water quality. In the words of UVM students Brynna Barbour and Vanessa Lam who designed and built the model, "it's a sustainable house boat design that is completely off the grid and is able to self-regulate while purifying the water that it calls home."

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BEYOND EFFICIENCY

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is its impact on water resources? Does it have a healthful indoor air quality? How much energy and resources are associated with the building materials?

Such questions are at the heart of green buildings, where in addition to energy efficiency, attention is paid to whole building, its relationship with its surroundings and the entire life cycle of the structure.

Many of us are familiar with LEED certification of buildings, which is a program that uses a rating score and third-party verification to encourage innovative holistic design.

Beyond LEED is the Living Building Challenge, a rigorous performance standard philosophically grounded in stewardship, and it's perhaps the hardest standard to achieve. Here is an excerpt from the introduction for Living Building Challenge Standard 2.1:

"IMAGINE a building designed and constructed to function as elegantly and efficiently as a flower; a building informed by its bioregion's characteristics, and that generates all of its own energy with renewable resources, captures and treats all of its own water, and operates efficiently for maximum beauty.

"IMAGINE a city block or a college campus sharing resources from building to building, growing food, and functioning without dependency on fossil fuel-based transportation.

"IMAGINE true sustainability in our homes, workplaces, neighborhoods, villages, towns and cities – Socially Just, Culturally Rich and Ecologically Restorative."

Seven performance areas the Challenge, which it calls "petals": Site, Water, Energy, Health, Materials, Equity and Beauty. Yes, the building must have aesthetic qualities as well! These Petals are subdivided into twenty "Imperatives," of which each is mandatory and measured based on actual performance, not modeled expectations. The Imperatives include:

The "Site" requirements contain criteria for urban agriculture, natural habitat and car-free living.

The "Water" standard is net-zero water. "Energy" is net-zero energy via renewable sources.

The "Health" standard includes criteria for a civilized environment, healthy air and 'biophilia' (ensuring a connection to nature and natural systems).

The "Materials" requirements prevent toxic chemicals per a "Red List," and have criteria for embodied carbon footprint,

responsible industry, appropriate sourcing, and conservation and reuse.

The "Equity" standard emphasizes human scale and humane places, democracy and social justice, and rights to nature.

The "Beauty" standard promotes beauty and spirit, and inspiration and education.

The Living Building Challenge illustrates how green building can be differentiated from energy efficiency. A green building approach incorporates a varying degree of the principles set out in standards like the Living Building Challenge, of which energy efficiency is one important strategy. But of course not all green buildings push the

thermal-energy efficiency envelope as far as Passive House. We need both standards, and each offers exciting opportunities.

Marc Companion works at the Vermont Housing and Conservation Board in Montpelier and teaches a Green Buildings course at the University of VT.

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MAKE YOUR COMMERCIAL PROJECT GO GREEN

By Adam Gonzales

Commercial development is going through a strong phase of building with sustainability. The Green Building Council estimates that by 2015, nearly 50% of all new non-residential U.S. construction projects will be sustainable projects. In dollars and cents, that equates to more than \$120 billion market value.

Additionally, according to a 2013 Deloitte report, driving energy use down is a growing goal for sustainable-project managers. In 2013, U.S. buildings account for 41% of energy usage, 73% of total electricity use, 38% of greenhouse gas emissions, and about 14% of water usage. LEED certifications are also on the rise, with about 2.5 billion sq. ft. of building space now LEED-certified (as of March 2013).

All told, this points to system-wide growth of sustainable practices in commercial building. But what constitutes success in specific sustainable projects in the overall commercial building sector? A clear understanding of an implementation plan is important. Having the ability to ask the right questions, measure the savings using accurate metrics, and get the financing together with the right financial backers are all key parts of the overall plan.

Another view from Certified Commercial Investment Member (CCIM) Institute suggests there are four ways to make your non-residential project go green.

1) Knowing Current Needs

Commercial developers need to have a real-time, first-hand knowledge of a property's overall needs to figure out what types of sustainable measures make sense.



How old is the property? Is it difficult to add in green assets into the building's core infrastructure? Looking at overall energy savings from an eco-friendly perspective will reduce utility bills for the building. Developers can also reap additional savings by using recycled materials on the current property.

2) Proper Green Certification

Commercial developers and real estate professionals must consult with U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) for green certification for both existing and new developments. Having third-party verification for LEED categories like materials and resources, water efficiency and indoor air quality gives your project the sustainable attention it deserves. Using various environmentally friendly paints or materials in your building can help qualify in these areas.

3) Builder Incentive Programs


To underscore the importance of using sustainable measures and to build participation from developers across the U.S., various industry organizations offer incentives for builders to increase sustainability. One group offering free energy

audits is the Building Owners and Managers Association International. Prospective sustainable developers are encouraged to check out an energy performance contract for existing buildings. Plus, BOMA's lease guide can help facilities operators in understanding green commitments for recycling programs, forklift rentals, hours of operation, and even tenant responsibilities.

4) Tenant Education

Developers and commercial real estate professionals can use their sustainable building measures to better educate tenants in green practices, LEED certification, facilities recycling, heating and cooling practices and more. Through this process, commercial tenants can also learn to exist more efficiently in the building, and create sustainable measures of their own.

For more information, resources and links on sustainability practices for commercial buildings, try the resource page at the Building Owners and Managers Association International site (www.boma.org/research).

Adam Gonzales is a licensed contractor from Miami who blogs about a variety of construction and DIY projects. 



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COLLECTIVE OF THE MOST SUSTAINABLE X-C SKI RESORTS IN NORTH AMERICA STANDS AGAINST CLIMATE CHANGE

By Roger Lohr

Many cross country (XC) ski areas operate in an environmentally-friendly manner, and some of these operators, who are exemplars using the most sustainable practices, have created a collective of the XC ski areas called "Cross Country Skiing Against Climate Change." These resorts are models of sustainability and in the effort to combat climate change the operators at these resorts practice what they preach such as: employing renewable energy, protecting scenic values and wildlife habitats, practicing water and energy conservation, reducing waste and reusing products, designing and building facilities in an environmentally sensitive manner, managing forest and vegetation properly, handling potentially hazardous waste properly, and educating their clientele and staff about environmental awareness and their eco-activity.

These sustainable practices are not typically million-dollar investments but they are meaningful accomplishments and the collective will disseminate information about many of their practices to hundreds of other XC ski areas across the US and Canada.

At Devil's Thumb Ranch Resort & Spa in Tabernash, Colorado, a geothermal heating system is used throughout the resort. The system consists of glycol-filled pipes that have been installed in the Ranch's on-site lake. Heat is transferred to the glycol from the water, and then heated to 105 degrees by compressors in each building. The resort has also installed EPA-approved specially designed chimneys that minimize emissions from wood burning fireplaces and used recycled asphalt for paving. "We continue to make a concerted effort to work with local suppliers and businesses and reduce our carbon footprint at every level," said General Manager Sean Damery.

The White Grass Ski Touring Center in Canaan, West Virginia has been awarded the WV Environmental Council's Green Entrepreneurs Award. The facility is heated with wood and uses about \$2.50 worth of electricity a day. Environmental education is a key element at White Grass as there are regular outings in the WV Highlands Conservancy and the Canaan Valley National Wildlife Refuge.

In the northeast US, the Maine Huts & Trails organization has built eco-lodges that are off the power grid with solar energy, wood-fired

van that tours up to the top of Mt. Washington to run on propane gas and installed an electric vehicle charging station, too.

Craftsbury Outdoor Center in VT has incorporated sustainability in its mission statement to be carbon-neutral. They use eight tracking solar panels for 35% of their electricity, highly efficient wood-fired boilers for heating, and a solar hot water system. Starting this winter, the waste heat from their snowmaking system generator will help to heat several buildings. Sleepy Hollow Inn Ski & Bike Center in Hun-

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what it preaches is Nipika Mountain Resort in BC, which is off the public power grid. It uses solar panels to supply energy needs. The resort's furniture was built on site with wood from trees that were killed by the Mountain Pine Beetle. Hardwood Ski & Bike in Oro Station, Ontario uses eco-friendly principles in the maintenance of their trail system and they work closely with the county forester to ensure that the forest remains healthy and vibrant through active management.

Boundary Country Trekking on the Gunflint Trail in MN offsets the carbon produced on the Banadad Trail (such as snowmobile grooming) by investing in reforestation in the area. This is a planting estimated at 75,000 trees. Boundary Country Trekking is one of the few XC ski operations that have a sustainability statement and a comprehensive implementation plan. Another Minnesota XC ski area, Maplelag Resort in Callaway is an active tree farm where it has planted thousands of trees and has created

more than 20 ponds to benefit wildlife there.

XCskiResorts.com editor Roger Lohr is the coordinator for the collective and he stated "For people who seek beautiful destinations to cross country ski and want to patronize businesses that fight climate change, the resorts in this collective are the places to visit. The Cross Country Skiing Against Climate Change collective will disseminate information about sustainable practices to other XC ski areas across North America in an effort to stand as an industry against global warming, which threatens many of the XC ski areas that exist today."



Craftsbury, VT Outdoor Center's 32kW solar array.



In Huntington, VT, Sleepy Hollow Ski Center is nearly 100% solar powered. Pictured is Eli Enman.

heat, and composting toilet systems.

Stump Sprouts Guest Lodge and Cross Country Ski Center in Hawley, MA produces more electricity than it consumes with its solar panels, and the lumber for buildings, furniture, and firewood is harvested on the property. They try to serve as much locally grown food as possible and grow most of their own produce and all food waste is composted. Lloyd Crawford of Stump Sprouts stated, "We use half the fuel that we used 10 years ago after upgrades to our vehicles and equipment." The Great Glen Outdoor Center in Gorham, NH upgraded an old micro-hydro system, which now supplies 80% of electric needs. They've also converted a

tington, VT gets a total of 32kW of power from solar panel arrays to provide for electric needs that includes power for a snowmaking system used to guarantee snow early in the season. A solar hot-water system heats 50% of the hot water use at the inn and the lights on the ski trail are being converted to LED lights. Sleepy Hollow Proprietor Eli Enman commented, "By the end of the year, we're looking forward to seeing that close to 100% of our total electricity would've been powered by solar energy and that includes our all-electric snowmaking system water and air pumps."

A sustainable Canadian resort that practices

SOLARIZING THE UPPER VALLEY

Cont. from page 10

they trust, so in addition to clear support from community leadership, Solarize Upper Valley relies on neighbors talking to neighbors about solar. Installers will be asked to offer a tiered pricing structure for residents in the Solarize communities. As more residents sign up to go solar, the price goes down for everyone. Talk about incentive to spread the word!

Sometimes it takes a deadline to move people to action. Each Solarize campaign will have a clear deadline for residents wishing to install a solar PV system

through this unique opportunity.

Vital Communities will work closely with the Solarize communities and their partner installers to design and implement effective outreach campaigns to engage residents, especially those who may never have previously considered solar as an option.

Solarize Upper Valley is not the first program of its kind. Vital Communities is working with partners in Connecticut to learn from the success of the Solarize Connecticut program and adapt the basic Solarize structure to suit the Upper Valley. More information about Connecticut's program can be found online at www.solarizect.com.

solarizect.com.

Solarize program leaders in Connecticut are beginning to see trends in local solar markets that extend beyond the immediate scope of the program. Preliminary numbers suggest that rates of solar adoption in and around Solarize communities remain elevated even after the end of the Solarize campaigns, indicating potential for broader positive impact on local solar markets.

Support for Solarize Upper Valley is provided by the John Merck Fund, which has helped develop similar programs in Massachusetts and Connecticut, and hopes to see iterations of the Solarize

model applied throughout New England.

Stay tuned for more about Solarize Upper Valley as the first round of Solarize communities launches into action this spring. Learn more and check for program updates online at www.vitalcommunities.org/solarize or contact Vital Communities' Energy Program Manager, Sarah Simonds (sarah@vitalcommunities.org).

Vital Communities plans to organize four rounds of Solarize Upper Valley over the next two years – so there is still time for Upper Valley residents to reach out to their local energy committees and community leaders about becoming a Solarize community.

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THE HIGH COST OF DOING NOTHING

GET Staff

Can you afford to buy expensive LED lights? Perhaps a better question might be whether you can afford not to buy them.

To be sure, LED lights are expensive. See ad for Oakes Brothers on page 28. A trip to the store showed a CFL replacement for a 60-watt incandescent bulb cost only about a quarter of what an LED of the same brightness cost. Prices, however, are going down rapidly on LEDs, and there are other reasons to buy them.

The cost of a light bulb is only a small part of what a light bulb costs. Two important questions are, "How much electricity does it use?" and "How long does it last?" The LED costs less than the CFL to run, and far less than the incandescent did. It also outlasts the CFL by about 5-to-1. This combination makes it less expensive overall.

While this is important in the home, it is even more important for commercial operations. According to the US Government's Energy Star web site, qualified commercial LED lighting offers an "unprecedented opportunity to save energy, maintenance and cooling costs and is a natural fit for cutting-edge renovation, new construction projects, or easy retrofits." (Visit www.energystar.gov/index.cfm?c=ssl.pr_commercial.)

There are five ways the LEDs can save money.

1. LEDs reduce consumption. A typical conversion from Metal Halide, High Pressure Sodium or Mercury Vapor lighting to an equivalent LED Light sees immediate savings of 60% or more on your lighting bills.

2. LEDs reduce maintenance costs. Many of our industrial and commercial LED Lighting products have life spans exceeding 100,000 hours or more. Bulb and ballast replacement will become a thing of the past.

3. LEDs require less frequent replacement. In some cases, such as a factory or warehouse with a high ceiling, replacing a light can have an appreciable labor cost for moving ladders and other equipment in preparation and cleanup. Work may even have to stop in the area while light replacement is underway. The cost of replacing a fluorescent light can easily exceed the cost of a new LED replacement.

4. Converting to LEDs may qualify for rebates and federal tax credits. Rebates may be available to help offset the initial expenditure of LED conversion. Some installations qualify for a 60¢ per square foot Federal Tax Credit! Also, lights qualified under DesignLights Consortium (www.designlights.org/) often qualify for rebates with utility companies, as much as 50% of the cost of the project.

5. LEDs provide better lighting, potentially making work more productive.

Source: www.myledlightingguide.com/

COOLING YOUR FOOD

with Energy Efficiency



Whirlpool, Maytag, Amana Multiple Models

This is a 17.5-cubic-foot refrigerator. It is 68"h, 28"w, & 32 7/8"deep.

Energy Details

- Highly energy-efficient models in a range of sizes ranked through an analysis of volume and energy use. Ranking: : 1
- Lifetime cost savings vs. Federal Minimum standard product: \$91-\$205
- Lifetime energy savings vs. federal minimum standard product: 1,140 kWh
- Annual Energy Use: 378 kWh

The energy efficiency of refrigerators and freezers has improved dramatically over the past three decades. A typical new refrigerator with automatic defrost and a top-mounted freezer uses about half the energy used by a typical 1990 refrigerator. So if your refrigerator is old, needs repairs, or is nearing the end of its expected 15-year life, it may make good economic sense to replace it now.

Buying a New Refrigerator

To find the most efficient refrigerators, download a qualifying product list from the ENERGY STAR Website: energystar.gov. To identify the most efficient products and prices, and where to buy them locally, check out the Top Ten USA listings: <http://bit.ly/e2gYn6>.

Beyond Energy Star

A new "Most Efficient" designation has been rolled out for appliances that are roughly 10% more efficient than Energy Star models and at least 30% more than non-Energy Star ones. Choosing a Most Efficient refrigerator over a non-Energy Star model could save you roughly \$200 during the life of the unit.

Use EnergyGuide labels wisely

Don't look for the Energy Star alone, since efficiency standards vary by refrigerator type. A non-Energy Star-qualified top-freezer might actually be more efficient than a side-by-side with the label. For an apples-to-apples comparison, use the annual operating costs and the kilowatt-hours per year the refrigerator uses, which are listed on the yellow EnergyGuide label.

When buying a new refrigerator, consider the following:

1. Low annual energy use

ACEEE (American Council for an Energy-Efficient Economy) recommends that you consider models that use at least 30% less electricity than that required by federal law. These products will meet the 2014 federal standard and may qualify for rebates—check with your local utility, appliance dealers, or Efficiency Vermont.

2. Choose top-mounted freezer configuration over side-by-side

Side-by-side refrigerator/freezers

use more energy than similarly sized models with the freezer on top, even if they both carry the ENERGY STAR. The government holds the two categories to different standards, allowing side-by-sides to use 10-30% more energy. Ice makers and through-the-door ice also add to energy consumption. To compare energy performance across different refrigerator types, look for the measured kWh/year either on the yellow EnergyGuide label posted on the refrigerator (and available on-line through many manufacturers' and retailers' websites).

3. Size matters

Refrigerators under 25 cubic feet should meet the needs of most households. Models over 25 cubic feet use significantly more energy. If you are thinking about purchasing such a large unit, you may want to reconsider. A smaller unit may well meet your household's needs.

4. Minimize multiple refrigerators

That said, if you need more refrigerator space, resist the temptation of moving your old refrigerator to the basement or garage for auxiliary purposes. Instead,

have it recycled and think about other options if you need more refrigerator space. Depending on your situation, it is generally much more efficient to operate one big refrigerator rather

than two smaller ones. If your big fridge is likely to be empty most of the year, maybe the better option would be to purchase an ENERGY STAR compact fridge. Compact refrigerators less than 7.75 cubic feet must be 20% more efficient than the minimum federal standard to qualify for ENERGY STAR.

5. Recycle your old fridge

Be sure you dispose of your old refrigerator properly. You can often have the utility or the city pick it up; they might even pay you to recycle it.

Household appliances, like all consumer goods, require energy and resources in their creation, operation, and disposal. Environmental consequences after disposal may include the introduction of greenhouse gases, heavy metals and toxic chemicals into the environment. Refrigerators, air conditioners, electronics, and fluorescent lighting products pose particular risks to the environment that should be kept in check; however, consumers should minimize the impact of

all disposed goods by recycling as much of the durable materials as possible (metals, plastics, glass) and by making themselves aware of and recovering any harmful substances involved. This reduces the impact of landfill waste as well as further mining of increasingly scarce resources.

What Should I Recycle, and Where?

Cooling equipment, such as refrigerators, freezers, dehumidifiers and room air conditioners involve refrigerants and insulating foams that release ozone-depleting substances and greenhouse gases once in a landfill. Older appliances may also contain PCBs or mercury. Newer products (made within the past 10 years) do not contain these toxic materials and use refrigerants and foam-blowing agents that are less harmful to the ozone layer, but they still contribute greenhouse gas emissions. Federal law

requires the removal and proper disposal of refrigerants but not foam products.

By law, the city must dispose of refrigerants, PCBs and mercury properly. Contact your utility and recycling renters to see if there is a rebate or bounty program in your area.

Source: <http://aceee.org/consumer/refrigeration>

Why is there a 60 watt heater inside refrigerators?

An incandescent lightbulb is a heater! LEDs run much cooler than incandescent bulbs and significantly cooler than CFLs. It doesn't make sense to add heat, even if it only does it when the door is open. Replace yours bulb with an L.E.D. for added efficiency.

Energy-saving Refrigeration Tips

If you cannot afford to buy a new refrigerator, you can minimize the energy consumption of your existing refrigerator somewhat by following these tips.

Check Door Seals

•Check the door seals or gaskets on your refrigerator-freezer. You can do this by putting a dollar bill in the door as you close it and see if it holds firmly in place. Or, put a bright flashlight inside the refrigerator and direct the light toward a section of the door seal. With the door closed and the room darkened, inspect for light through the crack.

Adjust the Thermostat

•The refrigerator compartment should be kept between 36°F and 38°F, and the freezer compartment between 0°F and 5°F.

Move the Refrigerator to a Cooler Location

•If your refrigerator is in the sunlight or next to your stove or dishwasher, it has to work harder to maintain cool temperatures.

Check Power-Saver Switch

•Many refrigerators have small heaters built into the walls to prevent moisture from condensing on the outer surface — as if the refrigerator doesn't have to work hard enough already! On some units, this

Cont. on page 27

COOLING YOUR FOOD WITH ENERGY EFFICIENCY

Cont. from page 26

feature can be turned off with an energy-saver or power-saver switch. Unless you have noticeable condensation, keep this switch on the energy-saving setting.

Minimize Frost Build-Up

Manual defrost and partial automatic defrost refrigerators and freezers should be defrosted on a regular basis. The buildup of ice on the coils inside the unit means that the compressor has to run longer to maintain cold temperatures, wasting energy. If you live in a very hot, humid climate and don't use air conditioning, defrosting may be required quite frequently with a manual defrost model. After defrosting, you might be able to adjust the thermostat to a warmer setting, further saving energy.

Manage Your Food and Storage Space

To keep your refrigerator from working too hard, let hot foods cool, cover foods, label items for quick identification, and keep your freezer full.

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PASSIVE HOUSE: Capturing Energy & Imagination, Part 2

By Ken Levenson, AIA

Continued from the October issue of Green Energy Times

The Passive House Methodology: Optimize what is already required to be built. In roughly five parts:

•**Part One:** Use the Passive House Planning Package (PHPP) to optimize all efforts. The PHPP energy model has been optimized based on continual research and data collection. Entering all required parameters into the PHPP is the basis of assuring predictability and high quality.

•**Part Two:** Optimize the thermal enclosure: Enclosure orientation, shading, and volumetric proportions should be optimized given project constraints. Be sure there is a continuous and verifiable airtightness control layer without breaks at component connections such as roof-wall connections. Provide good and continuous insulation with thermal bridge-free connections. And if the thermal bridges cannot be eliminated they are accounted for in the PHPP model. Windows and doors are fully integrated into the thermal and airtight control layers.

•**Part Three:** Optimize the passive heat gains – both solar and internal gains. Do this with orientation, shading, and sun exposure at first. Then account for lighting, equipment and people. Always be careful to avoid summertime overheating and excessive cooling demand.

•**Part Four:** Optimize the ventilation system with continuous high-efficiency heat-recovery balanced ventilation.

•**Part Five:** To account for drastically reduced heating and cooling load requirements, use smaller and simpler systems. While the heating requirement is never eliminated entirely, the elimination of traditional heating systems becomes possible.

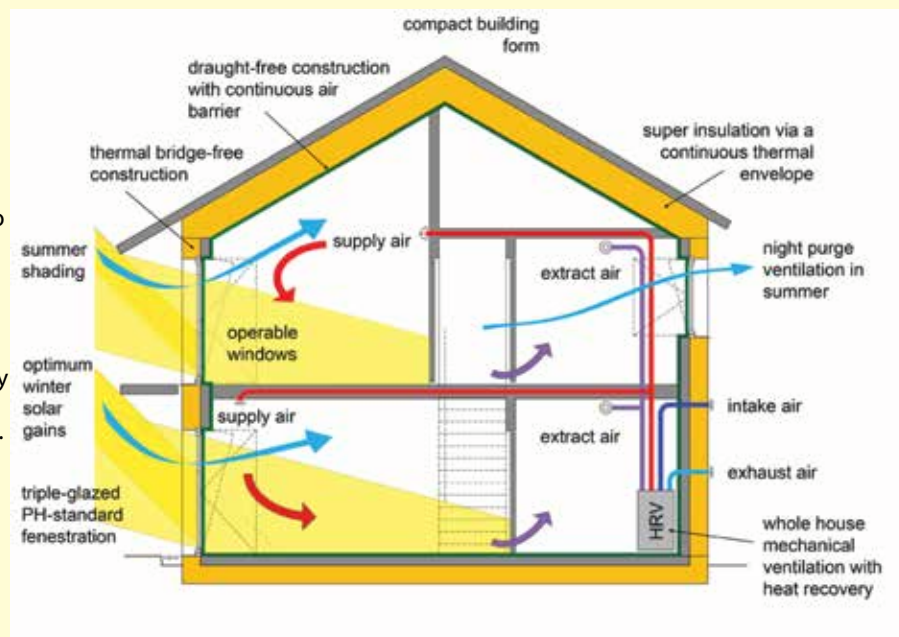
The Passive House

Components:

•**Airtightness:** Houses are air-tight with a continuous air-tight layer. This is the single most critical component in achieving efficiency, more important than even thermal insulation because so much heat is lost through air leaks. Once again, perhaps counterintuitively, airtightness is essential in providing indoor air quality, because you cannot control the quality of air unless you control that air in an airtight environment. Airtightness is also critical in avoiding condensation- and moisture-related damage in well-insulated enclosures.

•**High-efficiency ventilation:** With an airtight environment, mechanical ventilation must be provided. Fresh outside air is continuously provided to the living spaces while stale air is continuously exhausted from the bathrooms and kitchen. To avoid costly heat losses the air streams pass through a counterflow heat exchanger that enables up to 90% of the heat of the outgoing airstream to be conserved by being passed to the incoming airstream.

•**Thermal bridge-free construction:** As the insulation layer is continuous, forming a sort of thermos, connections and building elements passing through



the thermal enclosure need to be thermally broken, avoiding heat losses and potential condensation and the mold damage it can cause.

•**High performance windows and doors:** For comfort and energy balance it is important to install very good, often triple-pane, airtight, tilt-turn, or fixed-sash windows. Passive House windows ensure that the interior surface of the glass is warm, allowing even temperatures and

Cont. on page 34



INTERIOR WINDOW STORMS, PANELS AND QUILTS

By Bob Walker

You can decrease heat loss through your windows by installing window storms, panels or quilts inside. It is important to make sure all of these fit tightly to the window jambs or trim to prevent warm moist house air from getting behind and contacting the cooler window where it might condense.

"Tyx-All Plastic Interior Storms" and "Advanced Energy Panels" are reusable heavier gage plastic film panels available through Energy Federation Inc. (www.efi.org) at: http://www.energyfederation.org/consumer/default.php/cPath/21_2734

You can find a detailed instructions and materials list for making reusable homemade double-sided interior wood frame inserts at: <http://www.arttec.net/Thermal-Windows/index.html>. Window Improvement Masters is a company in Orford, NH that custom-makes a similar



Quilted window coverings on five picture windows and French doors. Photo courtesy of Window Quilt."

product to fit home owner needs: www.windowimprovementmasters.com. See their ad on back cover.

A company called "Warm Window" and

be securely fastened at all edges using one of several optional methods: magnets, sliding track, or hinged clamps. Custom-made quilts can be ordered from Window

others make multi-layer quilted fabrics for window quilts – google "window quilts". Unfortunately, many of these quilted fabrics have sewing penetrations through all layers, resulting in potential points of air and moisture leakage. This may cause condensation problems for you, so incorporating an unbroken barrier into the quilt might be helpful. Quilts should

Quilt in Brattleboro, VT. www.windowquilt.com

Home-owners can also make rigid window insulation panels from foam board, sealed at the edges with weatherstripping.

Bob Walker is the Executive Director for Sustainable Energy Resource Group (SERG) 802-785-4126, Thetford Center, VT www.SERG-info.org.



Window with insert by Window Improvement Masters."



Laughing in the face of fear ...

A Day in Vermont is Born



Last Light on Haystack, by Peter Huntoon

On November 7, 2013, Peter Huntoon wrote:

It gets dark early now.

Wild animals are on the move.

So are we, as we walk just a little bit faster to the car

Or to find the sunny spot to stand in.

Towering above Pawlet, Haystack Mountain basks in the waning warmth of an early November sunset.

Recently I noticed something interesting --- all the paintings and "in-process" images could give the casual observer the impression that when it comes to painting, I actually know what I'm doing.

The truth is that, at least much of the time, I don't.

And that's both exhilarating and liberating.

For those of you who paint, or are thinking about starting, let me assure you that each and every painting I do is a giant leap of faith into the unknown.

Starting is the secret. Laugh in the face of fear. Risk it all. Have fun.

Just add love and your best work is the inevitable result.



Peter Huntoon: Painting on a Porch

Peter Huntoon, a native Vermonter, has been painting professionally since 1994. He lives in Middletown Springs.

Educated in Vermont and Colorado, Huntoon received his BA in Art from Castleton State College. He has studied with contemporary masters Frank Webb, Zoltan Szabo, Cheng Kee Chee,

Stephen Quiller, and Robert Burridge, among others.

For over 20 years Peter held the position of Color Group Manager for Sto Corp, the world leader in architectural coatings. He remains a color consultant to the industry. Peter is also an adjunct professor of art at Castleton State College and is a founding member of the Vermont Watercolor Society.

After a year of planning, Peter chose to follow his heart, and laugh in the face of fear -- to pursue his lifelong passion as a full-time artist. Thus, on March 18, 2013, A Day in Vermont original was born.

A Day in Vermont is the name of a free and friendly email subscription that features Peter's work. A new painting by Peter is sent out twice a week, on Monday and Thursday mornings.

Each painting post includes a community forum, where he shares a little bit about the art, subject, or process. He welcomes comments, questions and hearing what you'd like him to paint. The new painting is available to subscribers via an online auction. One lucky subscriber wins a free print each month.

These authentic original paintings, in watercolor and oil, celebrate life in Vermont and capture the spirit of the Green Mountains. "Community spirit and authenticity motivate my work. I am ceaselessly inspired by Vermont's integrity, diversity, and capricious nature. Capturing her subtle

and sensational beauty in rich juicy paint is like roping the wind, brilliantly impossible. Her mysterious moods and change of seasons lead me on! I am an artist in love with Vermont. Sharing that love with you is my life's work," Peter proclaims.

Peter's wife, Mareva Millarc is an abstract artist, who has been painting professionally since 2007. She displays her work at the Vermont Institute of Contemporary Art (VICA), in Chester, Vermont.

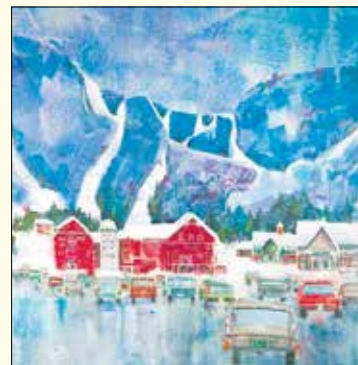
Peter's work is represented in public and private collections around the world.

"A Day in Vermont is like rolling with the current season -- an artistic journal."

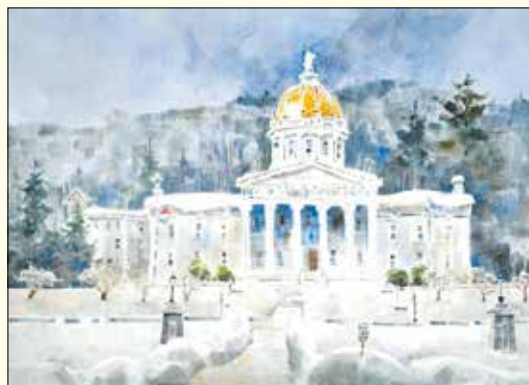
Peter continues, "I hope to have 20 good years of painting, exploring VT and sharing the journal with anyone interested. I will work 'til I can't hold a brush!"

"Color is my day-long obsession, joy and torment" - Monet

Check out his website, subscribe to A Day in Vermont, and browse the paintings to see if he has painted something you very well might recognize: www.peterhuntoon.com.



Sugarbush Resort by Peter Huntoon



Vermont Statehouse by Peter Huntoon

EMERGING FRONTIERS IN BIOENERGY



GRASS ENERGY

By Sarah Galbraith

The Vermont Bioenergy Initiative has contracted with Wilson Engineering Services, PC in Pennsylvania to conduct a State of the Science Review of Grass Energy in Vermont and the Northeast. The team was hired to evaluate the current research and understanding of growing and combusting grass for thermal energy in the northeastern United States by reviewing current literature and interviewing experts in the field.

Beginning in 2008, the Vermont Sustainable Jobs Fund (VSJF) began to explore the potential for grasses grown on marginal lands in Vermont to meet a portion of the state's heating demand and reduce the consumption of fossil fuels. The Grass Energy Partnership was formed among



Meach Cove VT switchgrass: "Switchgrass growing at Meach Cove Farm in Shelburne, Vermont." Vermont Bioenergy Initiative.

Biomass Energy Resource Center, University of Vermont College of Agriculture and Life Sciences, Vermont Technical College, and the Vermont Bioenergy Initiative to investigate agricultural best practices, combustion, and market development opportunities for grass energy.

There is an existing and growing body of knowledge on growing, processing and using grass for energy, but this opportunity has not been fully developed into a marketable option for growers, landowners, fuel processors and dealers, equipment manufacturers and vendors, nor homeowners and communities. There are still some uncertainties about the viability of using grass for energy, and as a result,

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WHY LOCAL AND CERTIFIED ORGANIC?

By David L. Rogers, Policy Advisor
Northeast Organic Farming Association of
Vermont (NOFA Vermont)

Some time ago I held a food system workshop that examined food choice and personal values. I asked attendees to list what they thought were the most important attributes of a sustainable and ethical food system. Here is what we came up with:

- Provides abundant, nutritious, affordable, high quality food
- Supports local economies, communities, family-scale farms, and businesses
- Builds healthy soils
- Protects & enhances natural resources
- Promotes biodiversity
- Avoids use of synthetic chemicals and fertilizers in food production and processing
- No use of genetically engineered organisms
- Maximizes energy efficiency
- Maximizes use of locally produced processing ingredients and production inputs
- Addresses global warming challenges
- Avoids use of synthetic chemicals & antibiotics in livestock production
- High regard for animal health, natural behaviors, and well-being
- Supports economic fairness and social justice (farmers, farm workers, consumers)



I think people who understand the intimate connections between our food system and important social, environmental and ethical concerns would support most of the above. Several of these attributes relate directly to the importance of local farms, working landscapes and local foods. All of the workshop participants strongly supported these and were very clear about how buying locally-produced food benefited them and their communities. (There were, however, different views of just what "local" means.)

A few of the attributes relate to specific farming practices (e.g., avoidance of synthetic chemicals, no use of GMOs). Others refer to the consequences of such practices – building healthy soils, protection of natural resources, promotion of biodiversity, maximization of energy efficiency, etc.

There was strong support for these attributes as well in the workshop, but uncertainty about how well our food choices support them – even when buying direct from the farm. After all, how many of us know enough about, for example, soil fertility, or biodiversity, to have an informed view of whether or not a



given farm is doing a good job in these and other areas? How can we know these things about the food that we buy? A good answer is to buy from local farms that use organic farming methods and practices. Most of the desirable attributes above are directly or indirectly connected to the central tenets of organic agriculture. Organic farmers rely upon high-quality composts to build healthy soils that produce safe, nutrient-rich foods; they preserve natural areas on their farms to foster biodiversity, as well as support populations of beneficial insects; they protect water resources by maintaining riparian buffers; they manage their livestock in ways that allow natural behaviors. The list goes on and on.

But questions remain. With so many organic practices, farmers often pick and choose which organic practices they will use. When asked, they might call their products "mostly organic," "almost organic," or something similar. But what does this mean? For example, do they mostly use compost, but sometimes use chemical fertilizers? Do they use any synthetic pesticides on their crops? Do they feed their livestock GMO grains? Many such questions would be reasonable for conscientious local food consumers to ask, though the answers might be difficult to interpret, or verify. In the workshop I termed this "the localvore's dilemma."

This brings us to the merits of certified organic agriculture and certified organic foods. Certified farms, as well as certified food manufacturers, are required to use only those methods approved by the USDA's National Organic Program (NOP) and to use them in accordance with comprehensive and specific NOP standards. These standards are developed and refined in ongoing discussions and consultations with a fifteen-member national board representing organic farmers, organic consumers, scientists and environmentalists.

All certified organic operations are inspected once or more each year by trained third-party inspectors who document compliance with applicable NOP standards. Those found to be "non-compliant" are required to correct their practices or risk de-certification. Only inspected and certified operations and products are, by law, allowed to display the well-known "USDA Organic" label. In Vermont, NOP inspections and certifications are carried out by Vermont Organic Farmers (VOF), a program of NOFA Vermont.

Since 2002, when the NOP began its work, millions of conscientious consumers have come to understand what USDA Certified Organic means and represents. There has been steady and dramatic growth in sales of certified organic products and the number of certified organic farms and food manufacturers. Today, sales of certified organic food top \$30 billion annually; there are eighteen thousand certified operations in the U.S. In Vermont, VOF inspects and certifies nearly 600 farms and food manufacturers, with combined sales over \$152 million per year.

Information about VOF's practices, NOP standards, a listing of VOF certified local farms and businesses, and more about the benefits of certified organic can be found at www.nofavt.org.

TURNING URINE INTO LIQUID GOLD

Fertilizer from Urine Means Clean Rivers, Sustainable Farms

By Abraham Noe-Hays

What if a polluting waste from your body could be transformed into a resource that benefited the environment? In what could be called "extreme recycling," 170 people in and around Brattleboro, Vermont donated 3,000 gallons of their own urine to be reused this year on a local farm as fertilizer, as part of a groundbreaking program run by the Rich Earth Institute. And although the idea can catch people off-guard at first, the project has had a very positive reception within the community.

"In the beginning we were very nervous what people would think," said Kim Nace, administrative director of the Rich Earth Institute. "But it's been a wonderful experience. As soon as people understand the purpose—how it helps keep the rivers clean and supports sustainable agriculture—they get right on board." Nace's reticence has evaporated in the last two years. She

chemical fertilizer.

Fertilizing with urine is not a new idea. It was vital to Chinese agriculture for 4,000 years, and continues to be used by gardeners around the world—including many in the United States. Since WWII, synthetic chemicals have displaced most natural fertilizers, but rising energy costs and resource depletion are driving up chemical costs, making the idea of local, renewable, urine-based fertilizer attractive again.

On the flip side, flushing urine down the drain is becoming increasingly expensive. To protect the aquatic environment from nutrient pollution from urine, the EPA and state governments are requiring towns, cities, and individual homeowners to spend heavily on technologies that remove nitrogen and phosphorus from sewage. "By keeping those elements out of the water from the beginning," said Noe-Hays, "we're solving the problem with less expense,



Jay Bailey and his team apply urine to a hayfield at Fairwinds Farm using a custom urine applicator. Photo credit: Betty Jenewin, Copyright 2013 Rich Earth Institute

now gives public tours of her home's urine-collecting toilet, and in November she addressed the delegates assembled at the U.N. in observance of World Toilet Day.

Urine contains high levels of nitrogen and phosphorus. Flushed down the drain, these elements cause algae blooms in lakes and estuaries, killing fish and destroying aquatic habitat. But if the urine is recycled to farmland instead of being flushed, levels of nitrogen and phosphorus in wastewater can be reduced by 75%.

On the farm, the same nitrogen and phosphorus make urine a powerful, locally-produced fertilizer. According to the Rich Earth Institute's research director, Abe Noe-Hays, one person's yearly output is enough to fertilize about a tenth of an acre of hay, or to grow 300 pounds of wheat—which would make a loaf of bread every day for a year. The Rich Earth Institute has been working with Fairwinds Farm, in Brattleboro, to conduct field trials. With support from a USDA SARE grant, they determined that test plots of hay treated with urine grew just as well as plots that received

and we are producing a valuable fertilizer at the same time."

This project is the first of its kind in the U.S., but in Sweden urine reuse is more widespread. Since urine is commonly sterile (and is even used as an emergency antiseptic), Swedish guidelines approve direct use of diluted urine as fertilizer on home gardens. Since the Rich Earth Institute collects from a wide population, it takes the precaution of sanitizing urine before reuse, either pasteurizing it or storing it at room temperature for a month so that the naturally occurring ammonia has time to destroy potential pathogens.

The Rich Earth Institute has the support of Brattleboro's Department of Public Works, and

will be working with two new farms in 2014. "It's amazing how fast this is growing," said Nace. "My dream is that within my lifetime urine recycling will become commonplace, and people in the future will wonder why we ever did it any other way."

To learn more, visit www.RichEarthInstitute.org

THETFORD ELEMENTARY SCHOOL EXCELS AT WASTE REDUCTION

by Roger Lohr

Thetford Elementary School (TES) in Thetford, VT received a 93% for recycling and composting efforts by representatives of the Natural Resource Recovery Asso-



Thetford Elementary student Katie Howard pitches in with Jean Graber and Marty Bouchard to work the compost. Inset pic caption: - students cking temperature of the working compost. Photo: Joette Hayashigawa

components of trash at the school such as cafeteria leftover food, liquid, bottles, cans and paper are valuable recyclable assets in the overall program, which includes a composting program on school property. Why do they do it? The program shows how the community can work together, be responsible consumers, reduces the waste stream, and incorporates student learning in environmental science, chemistry, sociology, economics, math, and communication in the process.



ciation who assessed systems at the school to reduce waste. On a visit to the school, arranged by the TES Composting and Recycling Committee I saw the school's efforts in action and discussed their composting program.

Students are an integral part of TES's waste reduction programs, which is supported by a half-dozen adults at the school. Students collect unbleached paper towels, which make up 96% of classroom waste and use them as carbon material for the compost system. The other

How can other schools set up similar on-site composting systems? Set up a meeting of stakeholders including the members of administration, faculty, kitchen staff, custodians, students, and interested parents. A representative of Highfields Composting Co., a consulting company in Hardwick, VT, was brought to the Thetford school and a \$5,000 grant was written to and accepted from the Wellborn Ecology Fund. The funds covered initial costs including the consultant's fee

for startup and technical advice, some faculty professional development curriculum work associated with composting, and materials to construct the composting bins.

The key ingredients to a successful composting program include: building compost bins to keep critters out, using recipes with food scraps to provide a balance of carbon and nitrogen, moisture, density, and porosity; getting the adults and students actively involved; installing a roof above the compost bin area; and finding participating partners for materials.

The elephant in the room is whether the compost smells or attracts rodents. The TES composting system proved that when done correctly these are not problems. The school has about 250 adults and students. There are five wooden bins each measuring about 16 square feet (4 by 4) that are insulated with foam board on the outside and have a top that lifts with a rope-and-pulley system. The front side of each bin is removable so it is easy to move the materials from one bin to the next. Some stirring of materials is necessary. Five gallon buckets of feedstock including food scraps, horse manure, sawdust, and paper towels are dumped and layered in one of the bins (using a 3:1 ratio of materials to food). A thermometer is used to monitor the temperature of the middle of the material pile in the compost bin. Upon reaching 160 degrees Fahrenheit the material pile is moved to the next bin and that transport mixes and aerates the compost, which cures in about a month when the original materials are no long identifiable.

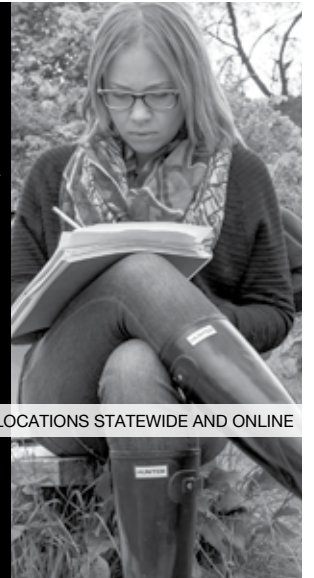
Students bring buckets of paper towels from each classroom to a central area and food scraps from the school lunch program are collected. The students are

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taught to use an iPad (remember this is an elementary school) to keep all the pertinent information about the composting process. A small team of students get the job done and new students rotate on to the team and are taught the particulars from the other students. The TES waste reduction annually saves about \$2,000 in trash hauling fees. The compost has been used for more than a dozen gardens on school property and some of the additional compost will be sold.

The analysis of school waste revealed that paper towels represented 96% of classroom waste and the idea to reuse it as feedstock in the composting system reduced the amount of trash enormously and repurposed the towels without emitting any gas or carbon in the landfill to dispose of it. TES is an exemplar for other schools, and is to be commended for their environmental concern and actions to control their waste. ♻️

NEW CONSORTIUM WILL MAKE VT A GLOBAL CENTER OF FOOD SYSTEMS EDUCATION

HIGHER ED INSTITUTIONS AGREE "VERMONT IS OUR CAMPUS"

Vermont has taken a giant step towards becoming a global center for food systems education. The leaders of six of Vermont's higher education institutions signed a groundbreaking agreement to create a premier destination for undergraduate, graduate, and professional degree students who want to learn how to advance sustainable and robust food systems. By pledging to use Vermont as a shared food systems campus, the founding members of this new consortium will offer students a rich array of cross-institutional experiences and strengthen the state's reputation as the national educational leader in innovative food systems.

Green Mountain College, Sterling College, the University of Vermont, Vermont Law School, Vermont Technical College, and the Vermont State Colleges are the founding members of the Vermont Higher Education Food Systems Consortium. The Consortium will work as a team to strengthen Vermont's place as a world-renowned center for food systems training, education, research, and outreach.

Over the next few years, Consortium members will focus on sharing courses,

internships, land-based learning experiences, faculty, and annual symposia across institutions. At the same time, the Consortium will develop a coordinated marketing campaign to tell the story of the diverse and creative educational opportunities available for studying food systems in Vermont.

"Vermont's higher education institutions have graduated generations of Vermont farmers, foresters and value added entrepreneurs," said Vermont Governor Peter Shumlin. "This collaboration offers students from across the country an unprecedented set of experiences in our working landscape. This will attract new youth to rural Vermont communities, spur innovation in the food and forest economies, and help all of us who are working to conserve Vermont's working landscape in production for the long-term future."

Chuck Ross, Vermont's Secretary of Agriculture, believes this consortium is poised to foster the next generation of food system leaders. "Vermont already leads the country in community-based agriculture and is renowned for its focus on sustainability. This consortium ensures the momentum will only build

in the years to come. I applaud these institutions for joining forces to build this important program, which, I am confident, will have a tremendous impact on our local, national, and global food system."

The food system encompasses the cultural, economic, ecological, sociological, nutritional, and health aspects of our food, including farming, value-added production, transportation, energy usage, marketing, distribution, and consumption. The Consortium members are united in their commitment to advance this work for Vermont and for communities throughout the region, the country, and the world. Through its collective educational resources, the Consortium will dramatically expand the innovative growth of the leadership, skill, and vision that the progress of the food system depends upon.

The Consortium grew out of the Vermont Higher Education Food Systems Council which was founded and facilitated by the Vermont Council on Rural Development (VCRD). For information about the Consortium, contact VCRD Executive Director Paul Costello at pcostello@vtrural.org or (802) 223-5763. ♻️

GRASS ENERGY

Cont. from page 29

some are hesitant to move forward with grass energy plantations or system installations that will support grass combustion. The State of the Science Review will evaluate what is known and establish the critical next steps for commercialization of grass energy in Vermont.

The final product of this work will be a report, due before the end of this year, containing key recommendations on next steps for commercializing grass energy in the Northeast, and specifically Vermont. The document will serve in strategic planning for the Vermont Bioenergy Initiative as well as the Vermont Agency of Agriculture, Food and Markets, and other constituents exploring grass energy.

Stay tuned to the next edition of this column for preliminary results from the state of the science review.

The Vermont Bioenergy Initiative is a program of the Vermont Sustainable Jobs Fund and partners with other organizations expanding the use of renewable energy in Vermont like Renewable Energy Vermont and the Energy Action Network. The Vermont Bioenergy Initiative also coordinates crossover with the Vermont Farm to Plate Network by providing resources and technical assistance to farmers, facilities, and communities to support energy crops to be grown alongside food production.

Sarah Galbraith is the program manager of the Vermont Bioenergy Initiative ♻️

RAISING OF THE SUN SHACK

A LIVING LABORATORY OF SUSTAINABLE DESIGN



Students managing timber frames in spring 2013. In the foreground: Garret Dunnells (left), Zenisha Shrestha and Ryan Bernstein (middle), Phurchhoki Shurpa (right). Photo: Greg Danilowski

By Nathan Larrimer

On October 19, the long awaited raising of the sustainable classroom, also known as the "Sun-Shack," took place at Colby Sawyer College. Students and community members enrolled in the sustainable design and construction class were involved in the raising of the Sun Shack. Fellow students and other com-



The class cutting the timbers last winter. In this picture is Drew Pehoviak. Photo: Greg Danilowski, Colby-Sawyer Communications Dept.

munity members joined in at the event. The project began in the fall of 2012 and is taught by Bryan Felice, who is the founding owner of Undustrial Timber Frames. The class studied areas such as building sciences, engineering, permaculture,

insulation, and design in order to turn this sustainable vision into reality.

Students managing timber frames in spring 2013. In the foreground: Garret Dunnells (left), Zenisha Shrestha and Ryan Bernstein (middle), Phurchhoki Shurpa (right). Photo: Greg Danilowski

In the fall of 2012 the class focused on envisioning the final design of their new classroom, and began cutting of the frames in February. Most of the main timbers are Eastern White Pine, and the braces were a combination of local yellow birch and black cherry. Every material was obtained within 35 miles of the College. This includes local loggers, cutters, and mills, as well as all the pegs of the Sun Shack, which were bought at Northcott Pegs in Walpole, NH. This small family-owned business supplies 98% of all timber frame pegs in the country. There isn't a due date for finishing the classroom, but the class is setting their sights on the end of the spring semester, 2014.

Bryan Felice has worked in various capacities in the environmental field and has a passion for sustainable construction. When asked about whether or not he sees this project as a representation of what a "transition town" can look like, he enthusiastically responded with, "Oh absolutely." Bryan explained the design

of the Sun Shack as being a traditional vernacular representation of New Hampshire, meaning that the design is based on the concept of 18th century house in the region. The classroom was "designed to link the Old traditional vernacular with new 21st century technologies and techniques."

The Sun Shack will be an education facility beyond the present construction. The classroom is facing true south and will capture thermal energy for growing plants inside. Houses and buildings to be built facing different directions because of the technical advances in heating systems. The building will be monitored for moisture management, heat loss, and other data after completion. It will be a living laboratory of sustainable design.

This project is not only an expectation of what is possible in a transition town, but it will also help the local community become empowered by its inspirational design and potential. The final product is meant to be a symbol of what is possible when a community comes together to make their vision of sustainability a reality.

Bio: Nathan Larrimer is a junior majoring in Environmental Studies at Colby Sawyer College. Nathan is the web developer for the Kearsarge Valley Transition Initiative, working with the community to progress towards a sustainable future. kearsargetransition.wordpress.com.



And up it goes! Top Pic: CSC Students Morgan Allen and Nathan Larrimer relaxing before lifting one of many timber frames. Photo: Greg Danilowski.



The Sun Shack finished during the evening (Photo: Olin Jenner)

WHOLE SCHOOL ENERGY CHALLENGE:

Engaging Vermont Schools in an Earth-friendly Project to Reduce School Energy Use and Save Taxpayers Money

By Larry Lewack, Deputy Director, (VEEP), Vermont Energy Education Program

Fourteen Vermont schools are working to reduce their school's energy use, and share their successes and their challenges along the way. The Whole School Energy Challenge engages the entire school -- from the students to the facility staff and the school administration. Each school team works to reduce the school's use of energy and associated costs, and to create a culture change among the school's stakeholders, resulting in greater energy awareness in the school community, and improved long-term energy management.

The Whole School Energy Challenge is a collaborative effort among Vermont Energy Education Program (VEEP), Vermont Superintendent's Association School Energy Management Program (SEMP), and Efficiency Vermont (EVT), designed to promote energy efficiency and "energy literacy" in schools throughout Vermont.

Over the year of the Challenge, teams:

1. Form their "Green Team" - students, faculty, administration, and facilities staff are invited to join.
2. Benchmark the schools' energy use, and assess opportunities to save.
3. Create and carry out an Action Plan to save money through equipment upgrades, operations and maintenance, and student action.
4. Measure their progress and communicate their results.

Each school team is assigned a specialist from VEEP, who works with the faculty champion, students and facilities manager to identify energy savings projects and make them happen. Monthly reports of each team's progress and energy savings are posted on a blog, at: <http://wsecblog.wordpress.com/>

Whole School Energy Challenge 2013-14 participat-

ing schools include:

- Lake Region Union High School
- Sharon Academy
- Twinfield Union School



- Essex High School / Ctr. for Technology
- Harwood Union High School
- Main Street Middle School (Montpelier)
- Browns River Middle School
- Mill River Union HS
- Northfield MS / HS
- Bellows Free Academy-St. Albans
- Brownington Central School
- Saint Albans City School
- Thetford Academy
- Essex Middle School

Project Highlights (year to date):

As of December 2012, the 10 WSEC school teams had achieved an average savings of 7% in their school's overall electricity usage. The best results were earned by the Lake Region High School team, who achieved a 28.2% savings in their school's electric bill from May - December 2012. Twinfield Union School's team also turned in an impressive showing, saving 18.8% in electric usage. Go teams!

VEEP also offers a range of programs to Vermont schools at no cost, to promote energy literacy in the classroom and beyond. Contact us to schedule an in-class presentation, apply for the Whole School Energy Challenge, sign up for a teacher training, or request a VEEP display at your community event. For more information, or to contact the program to arrange a presentation, see: www.veep.org

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FARM TO SCHOOL: HAVING FUN IN WOODSTOCK, VERMONT

By Abbey Keller

Harvesting carrots, cooking local food, and working hard at local farms are only some of the fun and educational activities that the Woodstock Farm to School group is doing.

Farm to School is a national program that strives to educate students (K-12) about nutrition, cooking with fresh produce, and to connect schools and students with local farms and food.

The Farm to School program at Woodstock Union High School/ Middle School meets every week, to join in gardening,

with the support of teachers, staff, and community members.

Recently, the club made a visit to Fable Farms and neighboring Kiss the Cow Farm, in Barnard, Vermont. At Fable Farms everyone helped harvest carrots, while also learning and experiencing the gardening techniques that the farm practices. An interesting tip that we learned was to plant clover in the aisles of gardens to prevent the soil from drying and to implant nutrients in the ground. The students enjoyed sampling the carrots they pulled from the ground themselves. After working in the carrot patch, the crew made their way to Kiss the Cow farm, a small business producing raw milk, organic eggs, meat, and more.

During the tour at Kiss the Cow Farm, the students had the chance to milk a cow -- the first time for many of them. "I really felt in touch with how much hard work and joy comes from picking

organic, local food!" exclaimed Claudia Mills, a seventh grader at Woodstock Middle School, "I experienced how sweet, delicious freshly picked carrots taste! I also discovered the strange sensation of milking a cow... at Kiss the Cow Farm!"

Lately, the Farm to School crew put on a fundraising dinner, serving homemade meals that were made with local ingredi-



Woodstock Farm to School group at Fable Farms in Barnard with their carrot harvest.

cooking, creating, and more after school for any students interested. The goals of the Farm to School program are "to increase local food options being served in the cafeteria, to facilitate a working school garden, and to build relationships between the school and the greater community" said Kat Robbins, who along with, Melissa Fellows, and Katrina Jimerson, lead the WUHS/MS Farm to School program



Woodstock Farm to School student Abbey Keller loves those carrots!

ents. The dinner was a great success, not only raising funds for the program, but serving food to students, staff, and faculty at the school and community members. The local food made by the students, with direction of the enthusiastic cafeteria cooks, taught the kids how local foods can be incorporated in one's everyday diet. Everyone is having fun in the Woodstock Union HS/MS Farm to School program, being involved in healthy delectable cooking, local and enjoyable field trips, and much more to come.

Abbey Keller is a 7th grade student at Woodstock Union School and enjoys the Farm to School program.

Editor's Note: More information about Farm to School at: www.farmtoschool.org. GET would like to share how your programs are teaching young folks about sustainable living. Submit your articles to georgek@greenenergytimes.org.

The Woodstock Inn Station & Brewery

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the Inn. "We have crews from all three of our shops there (Liberty, Portland, Exeter)," said Daniel Clapp, the NH Branch Manager. "It's a pretty big solar thermal project. On a commercial scale, in a brewery/restaurant situation, this is far and away the quicker return on investment with solar, with some pretty sweet state and federal rebates still available."

The system consists of 20 Wagner Euro flat plate collectors, and an American Solar Technics 850 gallon custom-made storage tank. The system preheats water for the propane-fired hot water tanks. This will cover a high annual fraction of the hot water load for both the Inn and the Restaurant. The collectors will produce an estimated 160 million BTUs per year, reducing propane needs by 1,700 to 1,900 gallons.

Incentives include the 30% Fed Tax Credit, NH PUC Commercial Rebate of \$11,340, NHEC Utility Rebate of \$18,900 and to top it off, they are eligible for a MACRS 5 year bonus Depreciation. "We estimate a 2-3 year return on investment," said Clapp. "The system will be up and running by December 20th." [PIC on pg 38]

6. The financial opportunities that the Inn and Brewery pursued are:

• The New Equipment and Construction Program

provided \$3060 for the Inn to install LED lighting, High Performance T8 lighting, and lighting controls in the new addition to the main building. Projected energy savings is 49% or \$2,000 annually.

• The Commercial and Industrial Heat Pumps Program

provided \$25,000 for three Carrier/Bryant central hybrid heat pump systems and two high efficiency

Cont. on page 38

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SEIA/ Solar Energy Industries Association: The SEIA Tax Manual to answer your solar related tax questions. www.seia.org
Dsireusa.com: www.dsireusa.com Renewables & Efficiency. Find state, local, utility, & federal incentives for renewable energy & energy efficiency.
IREC/ Interstate Renewable Energy Council: RE educational info. www.irecusa.org
NABCEP/ North American Board of Certified Energy Practitioners: This organization that tests & certifies PV system installers. Individuals are Certified, companies are not. www.nabcep.org
NESEA/ Northeast Sustainable Energy Assoc.: www.nesea.org
New Hampshire Sustainable Energy Assoc. NHSEA Focused on N.E. US, for consumers & industry- RE & clean building info, events. www.nhsea.org
New York Solar Energy Industries Association/NYSEIA www.nyseia.org
Clean Power Estimator: www.consumerenergycenter.org/renewables/estimator
Find Solar: www.findsolar.com
Energy Star Federal Tax Credits: www.energystar.gov/tax_credits.
Tax Incentives Assistance Project (TIAP): www.energytaxincentives.org
American Solar Energy Society (ASES): www.ases.org
Energy Efficiency & Renewable Energy Clearinghouse (EREC): eetd.lbl.gov/newsletter/CBS_NL/nl6/Sources.html
Federal Energy Regulatory Commission (FERC): www.ferc.gov
National Association of Energy Service Co. (NAESCO): www.naesco.org
National Renewable Energy Laboratory (NREL): www.nrel.gov
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NFRC independent rating & labeling system for the windows, doors, skylights www.nfrc.org/
NH Office of Energy and Planning: www.nh.gov/oep/programs/energy/RenewableEnergyIncentives.htm
Energy Efficiency & R/E Clearinghouse (EREC): eetd.lbl.gov/newsletter/CBS_NL/nl6/Sources.html
Federal Energy Regulatory Commission(FERC): www.ferc.gov
Solar Living Source Book: www.realgoods.com
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Solar Components: www.solar-components.com
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Solar Systems: NEsolar.com
National Solar Institute: www.nationalsolarinstitute.com
NeighborWorks® Alliance of Vermont: Low-cost energy loans - www.vthomeownership.org
Energy Guide: Unbiased advice about today's energy choices. Find ways to save, lower your bills & help the earth's environment - www.energyguide.com
Home Energy Saver: Interactive site to help you identify & calculate energy savings opportunities in your home. A lot of great information! - hes.lbl.gov
American Council for an Energy-Efficient Economy: Consumer guide to home energy savings - aceee.org/consumer
VT Energy Investment Corporation (VEIC): nonprofit organization that issues home energy ratings for new & existing homes. 800-639-6069 - www.veic.org
SmartPower: www.smartpower.org
Greywater Info: www.oasisdesign.net/greywater
Weatherization, Energy Star & Refrigerator Guide: www.waptac.org
Buildings Energy Data Book: buildingsdatabook.eren.doe.gov
The Office of Energy Efficiency & Renewable Energy (EERE): develops & deploys efficient & clean energy technologies that meet our nation's energy needs - www.eere.energy.gov
VPIRG: understand the clean energy resources available to VT - www.vpirg.org/cleanenergyguide
Track the Stimulus Money: www.recovery.gov/Pages/home.aspx
Dept. Public Svc. (CEDF): publicservice.VT.gov/energy/ee_cleanenergyfund.html
Renewable Energy World: www.renewableenergyworld.com
Renewable Energy VT: www.REVermont.org
The Energy Grid: www.pvwatts.org
350-Vermont: General group that coordinates a variety of statewide actions. To join this group go to: groups.google.com/group/350-Vermont
Vermont Tar Sands Action: Group working to stop the XL Pipeline and any other developments stemming from the Alberta Tar Sands. To join this group go to: groups.google.com/group/vt-tar-sands-action
Fossil Fuel Freedom: Group working to make Vermont's energy plan 100% free of fossil fuels: To join this group go to: groups.google.com/group/fossil-fuel-freedom
Consumer Guide to Home Energy Savings, Heating, Appliances, Refrigerator Guide, Building Envelope, Driving: <http://aceee.org/consumer>

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typically eliminating the need for traditional heating and cooling perimeter distribution systems. Note that you can open the windows in a Passive House – on a nice day, by all means let the breeze blow through.
•Integrated Design: The use of high-performance products alone is not enough – they must be fully integrated, and with Passive House all parts are integrated through the PHPP. It is often noted that high performance windows can't pay for themselves in energy saved – and this is certainly true considered in isolation. But if we also integrate airtightness and thermal bridge-free construction then the context is shifted and much greater overall savings with greater comfort is possible. The fully integrated design and construction of the Passive House is the synthesis of the scientific research preceding it and makes it a significant step forward in high performance building.

The Results:

The Passive House Institute has been single-minded in measuring performance, collecting data and consequently pushing the standard forward. The first great study was the European Union funded CEPHEUS (Cost Effective Passive Houses as European Standards) project. Two hundred fifty housing units across many European countries, by different architects and builders, for different clients, validated the energy model. Today PHI is collecting data around the world. In our region, Efficiency Vermont is collecting data on a number of residential projects in the state. All this is resulting in a new appreciation for how we can further optimize our low-energy buildings going forward. This shift to Passive House can unleash new ambitious imaginative energy, making new and astonishing things possible.
Find out more about Passive House at: www.passivehouse.com.

Ken Levenson is an architect, Certified Passive House Consultant, President of the non-profit New York Passive House, a founder of the North American Passive House Network, an International Passive House Association Affiliate Council Member, and COO of 475 High Performance Building Supply.

1 PHPP can be found at <http://passipedia.org/>.

2 There is a cooling demand limitation as well for Passive House like the Heating demand. ☺

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"A sustainable human population is one where the people living in a given geographically defined area do not live beyond the limits of the renewable resources of that area for either input (energy and matter) or output (food, material goods, and absorption of pollution)... thereby living in a manner that present and future generations of people, and all other life native to that area, will be able to enjoy a healthy habitat over the long term."



What is an optimum sustainable population for Vermont?
Read this valuable new report at www.vspop.org



By Larry Pleasant

Ingredient of the Month

BACTERIA, SLIME MOLD, AND LOVE

I have always wondered why Nature didn't stop with the bacteria. Those kids had it all. They had absolute and complete distribution throughout this blue orb in space we call home. Early bacteria transformed the air from a raging sulfurous stew to the docile nitrogen-oxygen-etc. mix we breathe today. They created the topsoil, a seething battleground where empires are built daily upon the bodies of untold predecessors. And in the process they transformed barren crust into fertile soil for a million future generations.

After you've conquered and altered an entire planet where do you go from there?

If the answer that popped into in your head was, "Jump into the car and get a burger with fries," you are correct. In fact, Nature evolved here on Earth for the past 4 billion years EXACTLY so you can jump into your car and get a burger with fries. The fact that you are doing so is in fact, proof of intent.

For the first billion years pretty much all of life on Earth was bacteria. But since Nature, like adolescents everywhere, strives towards increasing complexity; life marched on. Why bother! What is wrong with untold gazillions of Microcritters squirming around in endless polymorphous perversity? WHY did Nature decide to recreate the whole thing on a macro scale when it had it all going down on the

micro level already?

Standard answers like "Because!" and "I could tell you but then I'd have to kill you," don't cut it here in the world of pop science literature 101. We must therefore default to the "Common Sense Approach" (which is darn uncommon!).

"The fact that something is so is proof of intent."

Macro-critters world did not arise out of nothing. All animal life (that includes you, Cinderella) descended from some of my favorite crazy creatures fetchingly called slime molds.

"Yes Princess, you father IS in fact progeny of a slime mold."

I propose the formation of a new PR organization to lobby for a revamped image for these Honored Ancestors. There must be something sexier sounding than slime molds out there. How about Macroscellular Transmogrifiers?

Check this out. Slime molds start out as amoeba-looking things running around being happy microbes. But when food gets scarce (I am unable to ascertain what a slime mold actually eats so you will have to fill in this part using your imagination), when food gets scarce they come together and turn themselves cooperatively into a worm. What! Microbes coming together to form Macrobes! They then inch along in fine wormy fashion, apparently able

to sense molecules and head into Prime Slime Real Estate to put up shop.

Once they have found their new Slime Mold Shangri-La Retirement Home they plant themselves into the ground and grow a stalk which looks to this unbiased observer distinctly fungus-like;

a category in which they were formerly grouped. Eventually these faux-fungi pop out a crop of spores from the top of their "heads"; which fly in the wind spreading happy slime mold babies throughout the land. These proceed to live their natural course as microscopic amoeba-like creatures, repeating the cycle again and again through time and space and millennia untold.

I love slime molds because they bridge the gap between microbes and macrobes; between the unseen micro-world and the macro one we all exist in. If we can understand how thousands or even billions of individual cells and bacteria can become one functioning sentient being, we could perhaps begin to understand what life actually is; rather than endlessly describing its symptoms. And perhaps we could then understand what love is, that mysterious force that makes all living things thrive.

Bacteria transformed a barren planet



Slime mold growing on a beer can. Photo by SB Johnny

into a green one, fecund and prosperous with life forms. Long after we, dear reader are forgotten beyond time, bacteria will thrive and continue to alter their environment to make it suitable for future macro life forms.

Lest we think that bacteria are all bad eggs be reminded that good, healthful bacteria are an essential part of creating sourdough bread, real pickles, yogurt, cheese (or at least any really good cheese), kim-chi, miso, real soy sauce, and sauerkraut. Good bacteria help you to digest the food in your belly and to keep your skin from being overrun by fungus and other varieties of microbes. The good stuff crowds out the bad stuff which keeps YOU healthier.

Thank you bacteria!

Larry Pleasant is a writer, philosopher, part-time farmer and soap maker living and working in the Green Mountains of VT. Learn more at www.vermontsoap.com

GETTING BACK TO YOUR ROOTS

NUTRITIOUS EATING WHEN YOUR GARDEN IS BENEATH THE SNOW

Root vegetables that were nurtured by the soil's nutrients give us continued nourishment throughout the long winter months.

Carrots, turnips, and potatoes may be the mainstay of most root vegetable recipes, but what about trying some of their knobby, nubbly cousins, found alongside them in grocery store cases and farmers' market bins.

The following tips will help you unearth the secrets to cooking with lesser-known roots.

Beets. Raw or roasted, their earthy, sweet flavor far outshines the canned variety. Try them in: sSalads.

Burdock. These long, thin Asian favorites stay crisp after cooking for a texture that's a lot like water chestnuts. Try them in: salads, stir-fries, and sushi rolls.

Carrots. Raw, roasted, boiled or steamed, alone or in stir-fries this root vegetable is a mainstay in every kitchen.

Celery Root. Once peeled, the large knob reveals a creamy white flesh that tastes like a milder, sweeter version of the stalks. Try it in: grated slaws and salads, roasted vegetable medleys, soups, stews, and mashed potato recipes.

Daikon radishes. These pale white Asian roots taste a lot like their little red cousin, though they can sometimes be spicier. Try them in: salads, stir-fries, and pickle recipes.

Jerusalem artichokes or sunchokes. The sweet, artichoke-like flavor of these



veggies from the sunflower family gives them their name. Try them in: roasted vegetable medleys, stir-fries, or grated and eaten raw in salads.

Jicama It looks like a large, round potato, but jicama's crisp crunch tastes more like cucumber. Try it in: salads and tacos, or cut into sticks for a snack.

Parsnips Their delicate taste, a cross between carrots and parsley, makes these veggies a cold-weather favorite. Try them in: soups, stews, roasted vegetable medleys, and recipes for mashed potatoes.

Potatoes. Roasted, baked, boiled or fried, alone or in stews and soups this versatile root vegetable is a familiar mainstay.

Rutabagas. With a milder, sweeter flavor and a creamier texture than turnips, rutabagas are a gardener's favorite because they're so easy to grow. Try them in: Soups, stews, roasted vegetable medleys, and recipes for mashed potatoes.

Sweet Potatoes. Roasted, baked, boiled or fried, this is a nutritional wonder that is becoming a common addition to our diets.



Maple and Mustard Roasted Root Vegetables

- 1/4 cup maple syrup
- 2 tbsp. Dijon mustard
- 1/2 tsp. garlic powder*
- 2 tbsp. olive oil
- 1/2 tsp. salt
- 1/4 tsp. pepper
- 1/2 cup coarsely chopped onion or 20 pearl onions, peeled
- 5 cups coarsely chopped or sliced veggies of your choice; turnips, parsnips, rutabaga, carrot, potato, yams, beets and/or golden beets.

Preheat oven to 425°. Toss veggies and onions with the olive oil, salt and pepper on a baking pan. Roast in oven for 20 minutes, then remove and re-toss on baking sheet. Cook 15 minutes more. Toss again. Cook another 15 min. Combine maple syrup, Dijon mustard and garlic powder or *crushed garlic in a small bowl. Drizzle the maple mixture over potatoes and veggies and mix to coat well. Cook again until veggies (beets and potatoes will take the longest) are soft and glaze starts to caramelize and brown a bit. Yields 6 servings.

Recipe courtesy of the Vermont Maple Sugar Makers' Association. More recipes are available at vermont-maple.org

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LOW VOC COATINGS

Cont. from page 21

the homes or furniture there are often better choices -- healthier, more cost-effective, and in the long view better for the environment -- than low-VOC products. One bonus is that tung oil comes from a tree that helps renew the oxygen in the air and consumes the carbon dioxide produced in the atmosphere.

The Sutherland Welles website is at www.sutherlandwelles.com



Photos courtesy of Sutherland Welles Ltd

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Green Tips

By Deborah DeMoulpied, Bona Fide Green Goods

A Burning Tip for Home Products

Ho, ho, ho ... how did we get flame retardants in just about everything in our homes? It's in furniture, drapes, coffee makers, mattresses, microwaves, and carpets, and in electrical cords, TV sets, pillows, baby products, cars and blankets. Oh my. These come without precautions, explanations or tags! Well, maybe some had a big tag saying they met some fire-safety standard.

What started with well-intended fire safety preventative measures ended up with the chemical industry dousing anything they could get regulated with chemical flame retardants. Heck, everything has the potential to burn, so we had better put flame retardants on them just in case, including diaper changing pads and baby car seats. When was the last time you saw a baby smoking while sitting in its car seat?

Turns out that the amount of flame retardants isn't even enough to do much good but enough to do us no good. Banned long ago in Europe, many of these chemicals have only recently been banned in California for use on furniture. It's no wonder that Americans have flame retardants 10 to 40 times higher in their blood than Europeans. Flame retardants are endocrine-disrupting chemicals and are a link to a host of problems such as neurological and reproductive disorders, and cancers.

When applied to products, they do not adhere well, so they easily can

rub into your skin, become airborne or end up in dust. Most are persistent organic pollutants so they stick around in the environment and in us for a really long

time.

This is the time of year for purchasing gifts and home items; choosing products without flame retardants is a good idea. Doing interior home renovations such as installing new carpets probably is something that should wait until the windows can be open. And the clincher in all of this is, for all of you who pride yourselves in setting a very low thermostat at night to save fuel (and the planet) and use an electric blanket to save energy....guess what?



That heating blanket is covered in flame retardants.

An old-fashioned, red rubber hot water bottle anyone? They actually work.

Deborah deMoulpied is owner/founder of Bona Fide Green Goods, an earth friendly department store in Concord, NH. Bonafidegreengoods.com won the Webby Awards Green Honoree in 2011. Deborah is also faculty of the Anticancer Lifestyle Program, teaching patients about environmental toxins and healthier solutions.

FOOD CO-OPS: BUILDING FOOD SECURITY SINCE 1844

By Erbin Crowell

On December 21, 1844, the Rochdale Society of Equitable Pioneers opened a humble grocery store in the north of England. The offerings on the shelves were modest: little more than butter, flour, oatmeal and candles. The vision of the Pioneers, however, was ambitious.

"What was the motivation of the Rochdale Pioneers, who codified the values and principles on which the co-operative movement has based since 1844?" asked Dame Pauline Green, President of the International Co-operative Alliance. "We know it today as food security."

At a time when access to nutritious food was limited and adulterated products were common, these activists saw an urgent need for an alternative. Basic products such as flour, coffee and sugar were expensive and often contaminated, mixed with limestone, sawdust or other ingredients to increase their weight and cost. For working people, options were limited and many had no choice but to shop at the local "company store."

Today, the aftermath of the economic recession has had a dramatic impact on the ability of people to provide themselves and their families with healthful food. In the U.S., 23.5 million Americans

(including 6.5 million children) live in areas with limited access to affordable and nutritious food, particularly in low-income neighborhoods and communities. In New England, the relative cost of high-nutrition, less processed foods is among the highest in the country, when compared to low-nutrition, highly processed foods. Additionally, childhood obesity rates are higher in many parts of the region than the national average.

Food co-ops in New England have been pioneers and innovators in food security. Some date back to the Great Depression, while others were founded in the 1970s and 80s, emerging as community-based responses to limited access to healthful, affordable food. In recent years, a new wave of food co-ops has emerged, reflecting growing interest in local foods and democratic ownership. Rooted in their communities, food co-ops are an effective tool for building healthy food access, stable markets for local producers, and sustainable jobs.

As food security has again emerged as an urgent issue in our region, the member co-ops of the Neighboring Food Co-op Association (NFCA) have been working to develop solutions that balance financial sustainability with offering healthy afford-

able food, supporting local economies and building fair relationships with workers and producers. In collaboration with the Cooperative Fund of New England, Hunger Free Vermont and the New England Farmers Union, the members of the NFCA are sharing what they have learned from existing food co-op programs — Food for All, Co-op Basics, Pennywise Pantry, Co-op Cares — and creating new approaches to making healthful food and member-ownership more accessible.

In their day, the Pioneers saw a solution to their challenges in economic empowerment through democratic community-owned businesses. Together, our Neighboring Food Co-ops are reaching back to their roots, building on a legacy of food security as we look toward the future.

To learn more about the NFCA's Healthy Food Access work please visit: www.nfca.coop/healthyfoodaccess.

Erbin Crowell serves as Executive Director of the Neighboring Food Co-op Association, a network of over 30 food co-ops and start-up initiatives, locally owned by more than 80,000 people like you. He serves on the board of the National Co-operative Business Association and may be contacted at erbin@nfca.coop.

Spirits for a Sustainable Future in Windsor, VT



The Silo Distillery - pure, clean, sustainable

By George Harvey

It happens so often that when we start writing about one thing, many stories appear. This is certainly the case with the Silo Distillery.

It is partly a story of the building that houses the Silo Distillery. It was designed by David Hamilton of Geobarns, LLC, of White River Junction, Vermont. Even

a great degree for reuse for heating the building itself. This does not mean other sources of heat were neglected. The building is designed and constructed to take advantage of sunlight for both passive heating and light.

Such a building is not created thoughtlessly, and George Abetti, president of Geobarns speaks to the close contact that was needed to keep it on track. He and the Silo's owners, Peter Jillson and Anne Marie Donovan, exchanged over 1600 emails dealing with all sorts of details.

Geobarns did the design and took responsibility for the building shell and interior construction, but there are other organizations worthy of note. Blanchard Contracting of Windsor did the excavation and concrete work. Bethel Mills, the oldest family-run business in Vermont, provided building-shell and interior materials. Insulation was installed by Weatherization Works, plumbing by Green Mountain Plumbing, and electric work by Stoney



The 'still' in the production room with the copper columns and equipment used for the distilling process (make this pic quite big with the tasting room possibly as a partial inset.



The enticing tasting room

Electric. Windows are Andersen Silver Line.

A look at the pictures gives an idea of how impressive the building is. Wood, glazing, and the equipment of the business all seem to match in a manner that tells a story. And what a story it is.

Distilling alcohol is not just a matter of lighting a fire under a vat and watching alcohol drip into a bottle from a metal tube. That is, perhaps, part of the history the Silo acknowledges. But it is more.

The process starts with choosing source

though it was built with an eye to frugality, it is the spectacular result of a collaborative creative and efficient effort.

It has its green credentials. Its use as a distillery means heat has to be used for processing, and that heat is trapped to

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materials. Grains come from local farms, much of it from Great River Farm in Windsor. They are of the highest quality and are organically grown, whenever possible.

Water for the Silo has to be pure. After it comes from the town of Windsor, it is further purified in the Silo's own plant through reverse osmosis. This ensures the highest possible quality.

Elderberry and Juniper Story

Elderberries and juniper berries were not as easily available on the market as the Silo's owners would have expected, when they started getting underway. A chance meeting with a forager having good connections secured a set of high quality sources. Apples come from Springfield, Vermont's Wellwood Orchards.

The Distilling Process

The grain is put through a hammer mill to make it into a fine powder. It is then mixed with water to make a mash, heated to a precise temperature for a starch conversion by natural enzymes, to a higher, precise temperature to eliminate

bacteria, cooled, and inoculated with a special strain of yeast for distillers.

Unlike the beer brewing process, which has the grains separated before fermentation, the mash is allowed to go through the fermenting process. It is then put into the still, where it is heated to yet another precise temperature, so the alcohol is vaporized, but the water is not. This produces a product that is subsequently adjusted to precise levels of alcohol and bottled.

Like most other processes that lead to a product, there is waste. The mash, from which the alcohol is nearly entirely removed, still has food value. It goes to Circle T Ranch, in Hartland, Vermont, where it is fed to very appreciative cows. This brings the whole distilling process full circle, locally.

The cows get what is in the mash, and we get what is in the bottle - local and organic, clean and as pure as it can get. It all seems perfectly fitting. White River Junction and Springfield

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The Woodstock Inn Station & Brewery

Cont. from page 33

Mitsubishi mini split systems. These replace an old propane-fueled, inefficient heat and hot water system, and also provide cooling in the expanded main building. Projected savings from this conversion is \$13,900 annually.

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HOLIDAY GIFT GIVING

By Jessica Goldblatt

'Tis the season of GREEN—and we don't mean your shopping budget! This holiday season, remember to shop locally, and choose environmentally friendly gifts and gift wrapping.

Choose the useful and sustainable gifts. Prefer quality over quantity and longevity over disposability. A foodie might like wooden tools and utensils, cast iron cookware, quality bake ware, or organic wine. Gifts for the home could include natural candles, Vermont-made wool socks, or something you make yourself. Fashionistas and outdoor enthusiasts alike will appreciate quality garments made from natural fibers. Green gift alternatives are everywhere!

Indoors much?

With colder weather, indoor air quality becomes important. We should reduce our exposure to such chemicals as harmful VOCs, carbon-based chemicals that easily evaporate at room temperature. The range of problems these chemicals cause is very wide, from minor irritations to life threatening conditions. While we can smell low levels of some, others have no odor.

Many products we have in our homes release fumes or "off-gas." Some examples are building materials, carpets, adhesives, composite wood products, paints, solvents, upholstery fabrics, vinyl, air fresheners, cleaning and disinfecting chemicals, cosmetics, fuel oil, and gasoline.

For new purchases, consider the following:

- floor models that have been allowed to off-gas in the store
- solid wood items with low emitting finishes

• new products that contain low or no VOCs (environmentally preferable products)

A great way to reduce VOCs is to eliminate our use of conventional cleaners. You can make a dramatic change to your home's indoor air quality by simply choosing safer, non-toxic alternatives. A range of non-toxic cleaning products is available at local health food stores, grocery stores, and online. You can also make your own cleaners from everyday products like vinegar and baking soda.

Also, choose natural, untreated fabrics, and natural paints and finishes when possible. The change will have your family breathing much sweeter and more healthful air!

Get some common houseplants from a local nursery, such as palms, ferns, corn plants, dragon trees, rubber plants, weeping figs, English ivy, peace lilies, florist mums, gerber daisies, dumb cane, schefflera, orchids, spider plants, philodendrons, arrowhead plants, pothos, dwarf bananas and Chinese evergreens. Why? Houseplants can help remove certain harmful VOCs.

Snuggling Down: Organic Mattresses vs. Conventional Explained

We spend over a third of our lifetimes in bed, and sleep is when our bodies heal, renew, and rejuvenate. Standard mattresses are full of artificial materials, many of which are known carcinogens. These chemicals off-gas over time, and we breathe the fumes while we sleep.

An organic mattress is one of the best things to consider for good health. Using them eliminates a significant source of our total chemical exposure, and they are also highly recommended for offering superior comfort.

Jessica Goldblatt Barber is the owner of Interiors Green, a home and living store, in Bethlehem, NH. Jessica supports sustainable principles in her everyday life and when creating designs for clients. www.interiorsgreen.com

• **The SmartSTART Program.** This on-bill financing program provides a means for commercial & industrial members to have energy efficient technologies installed at their business with no upfront cost. The cost of any improvement(s) is repaid over time on the member's electric bill, using the savings generated. The Inn installed a condensing boiler connected to inn and restaurant heating zones and a high-efficiency modulating domestic hot water system that supplies hot water for the entire facility. Loans totaled \$41,414. Projected savings are 27% or \$15,700 annually.

• **Commercial Fossil Fuel Program.** The Inn completed two projects. In 2011 a high efficiency hot water boiler was installed, replacing an old and inefficient oil fired system in the Deachman House, a building that contains guest rooms and the Inn's laundry facilities, with an incentive of \$5,000. Projected energy savings are 31% or \$3,000 annually. An ozone generator, which reduces hot water usage, soap usage and drying time while also eliminating "super bugs," was installed in 2012 in the Inn's laundry center with an incentive of \$5,498. Projected energy savings are 25% or \$4,700 annually.

• **Commercial Renewable Energy Program.** The Inn received an incentive of \$19,250 from the Commercial Renewable Energy Program to install an 18 kW PV



The latest addition is for solar hot water collectors, estimated to produce 160 million BTUs per year, reducing propane needs by 1,700 to 1,900 gallons. The system is currently being installed by Revision Energy from Exeter, NH.

system on the new addition to the main building. Fifty-four solar panels make up Lincoln/Woodstock's first solar supported business! Estimated production is in excess of 20,000 kWh annually.

What's most amazing is the bottom line cost for this project. Owner, Scott Rice explained why the decision to undertake this project was a no-brainer: "The energy programs that made it all possible were because "25% of the costs were covered by a USDA Rural Development Program (REAP) Grant, 25% from NHEC, 17-18% from the standard state rebates, and 30% of the balance came from the Federal Incentives. \$7,500 came from the NH Retail Merchants Association, towards the furnace and hot water upgrades. The balance of the \$40,000 was financed the NHEC smart start program at 4% through my electric bill. Only 16-17% of the cost was out of pocket. After the bonus depreciation this year, the finished project will be almost free!"

KEEP YOUR HOLIDAY CELEBRATIONS OUT OF THE LANDFILL, ALL YEAR ROUND

By Clare Innes

Here's a mashup of ideas for keeping your holiday spirit out of the landfill all year 'round:

Say NO! to artificial Christmas trees. Here's why:

-- Think a real tree poses a greater fire hazard? Think again. Artificial trees are made with polyvinyl chloride, which is toxic to inhale if there is a fire

-- North American Christmas tree farms employ more than 100,000 local people; 80% of artificial trees worldwide are manufactured overseas.

-- Make a day of it and go to a local tree farm where you can cut your own, or purchase a potted tree and plant it in your yard after the holidays. You'll also take home some sweet memories.

-- Tinsel and spray-on snow are nearly impossible to remove, and trees can be accepted for recycling only if they are completely free of anything Mother Nature herself didn't install! Otherwise, those nasty additives make that tree fit only for the landfill.

Use recyclable or reusable wrapping paper for gifts.

In Chittenden County, wrapping paper is NOT recyclable if it is printed with metallic inks or made of foil or plastic. The best material to use is something your recipient can reuse, such as a bandanna, a tea towel, a reusable cloth gift or shopping bag ... the possibilities are endless.

If you still want to use wrapping paper, complete the recycling loop by purchasing wrap made with recycled paper. Let your favorite retailer know you're looking for it and they'll know that there's a demand for it.

Recycling tip: Speedy recycling starts on your living-room floor on the Big Day: Sort recyclable paper into your recycling bin (NOT in a plastic bag). Put trash -- ribbons, plastic and metallic paper and wrappings -- in a trash bag, and you'll get 'er done as you go!

Use recyclable, reusable, or biodegradable gift decorations.

Plastic and cloth ribbons and bows are big no-nos because they can't be recycled. A better option is to tie on an



ornament that can be used on your tree, a knick-knack that will be enjoyed for years, or pinecones that can be composted or returned to the forest after use.

Regift!

Save gifts that aren't quite what you need for someone who will appreciate them. If you can't think of anyone you can pass it on to, bring it to a local charity or resale store <http://bit.ly/198E6jM>, or a ReUse Zone at a CSWD Drop-Off Center <http://bit.ly/1f8x3c0>, and someone else will be glad to make use of it.

Don't scrap your food scraps.

After your big meal, keep your plate scrapings and prep scraps out of the trash and stash them instead in a FREE food scrap bucket available at all CSWD Drop-Off Centers <http://bit.ly/1f8x3c0> and Green Mountain Compost <http://bit.ly/1aKwUXf>. When the bucket is full, bring it in and we'll use your scraps to make compost. We accept all types of food scraps: meat and bones, veggies, dairy products, and egg and seafood shells. And it's FREE!

Remember: "The best things in life aren't things."

Give an experience, such as a horse-back-riding jaunt, skateboard lessons, movie tickets, or a promise to spend time together doing something your recipient loves to do. An online tool called sokindregistry.org <http://bit.ly/1TyLCT> offers fun ways to make gifts more personal and timeless.

Clare Innes is the Marketing Coordinator, Chittenden Solid Waste District. E-mail: info@cswd.net, Hotline: 872-8111.

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Announces a Breakthrough in Window Insulation Technology

DON'T REPLACE YOUR WINDOWS... IMPROVE YOUR WINDOWS!™

HYBRID FRAME TECHNOLOGY –

A fusion of aluminum & wood

- Ultra stiff and rigid – means large panels without cross members. No bowing – great for retail storefronts
- Elegant profile in your choice of wood & finish
- Aluminum member sealed inside thermal barrier
- Nested for narrow frame profile
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PATENTED DUAL FILM TECHNOLOGY –

Doubled for maximum R value

- Four layers of transparent thin film within ¾": R4
- Add to single glazed window: R5 (μ.20)

FULLY GASKETED – for superior air seal

- Engineered for ideal seal – prevents over-compression



These panels can be installed in any building – home, office or industrial. Our panels have a higher insulation rating and provide greater comfort than most replacement windows, yet are a fraction of the cost. Our panels are custom made to fit your existing openings, protecting, preserving and improving your original windows.

- Improve comfort
- Eliminate drafts
- Reduce heat loss in winter
- Reduce heat gain in summer
- Preserve historic windows
- Enjoy the view
- Allow the sun in and keep the cold out

To learn more, contact us:

Introductory price*
\$18 / sf

* 10 sf minimum (\$180). Panels will be painted in standard white or clear-coat finish. Alternate colors, finishes, delivery, installation or applicable taxes may be extra.



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